Is Conditioned Reinforcement by Observation a Verbal Behavior Developmental Cusp?

Alexandria M. Lanter

Submitted in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy
under the Executive Committee
of the Graduate School of Arts and Sciences

COLUMBIA UNIVERSITY

2018

ABSTRACT

Is Conditioned Reinforcement by Observation a Verbal Behavior Developmental Cusp?

Alexandria M. Lanter

In 2 studies, I tested the effects of an observational conditioning-by-denial intervention on the demonstration of conditioned reinforcement by observation, observational performance, and observational acquisition of new operants. In Experiment 1, I selected 6 children educationally classified with autism spectrum disorder and multiple disabilities. The participants were 2 females and 4 males who ranged from 5.5-8.2 years old. Participants were selected from one school that implemented a Comprehensive Application of Behavior Analysis to Schooling (CABAS®) approach. I conducted a series of pre-intervention reinforcer assessments that tested 1) the conditioned reinforcement effects of known reinforcing stimuli (edibles) and non-preferred stimuli (binder clips) on a mastered task, and 2) the reinforcement effects of non-preferred stimuli (binder clips) on 3 learning tasks across each participant. These reinforcer assessment probes showed all participants' rates increased when a known reinforcer (edibles) was delivered compared to non-reinforcing stimuli (binder clips) on the mastered task. Participants did not demonstrate learning when delivered non-preferred stimuli (binder clips) for correct responses on learning tasks. Following the pre-intervention reinforcer assessments I conducted probes for a) conditioned reinforcement by observation b) observational performance and c) observational acquisition of new operants. Pre-intervention probes showed all participants did not demonstrate conditioned reinforcement by observation, or observational acquisition of new operants and 5 out of 6 participants did not demonstrate observational performance. The independent variable was an observational conditioning-

by-denial intervention. During the intervention the participant was paired with a known peer, and both children were separated by a partition but were able to see and hear the researcher but not each other. The only thing both the participant and peer could see were each other's transparent cups, which were attached with Velcro® to each child's desk. Both participants were given a mastered task. Each time the peer emitted a response the experimenter delivered neutral stimuli (binder clips) into his/her transparent cup, in view of the participant. The intervention continued until the target participant vocally manded/requested for the neutral stimuli and/or made a physical attempt to gain access to the stimuli one or more times across two consecutive sessions. Post-intervention data suggest that neutral stimuli (binder clips) became conditioned reinforcers for mastered and learning tasks as function of the intervention for all 6 participants. Responses to denial of non-preferred stimuli delivered to a peer (conditioned reinforcement by observation), observational performance, and observational acquisition of new operant responses increased in 4 out of 6 participants who did not respond during pre-intervention probes. In Experiment 2, I sought to determine if conditioned reinforcement by observation is a verbal behavior developmental cusp. Experiment 2 was a replication of Experiment 1, with two different reinforcer assessments that tested: 1) the conditioned reinforcer effects of neutral stimuli when the participant was alone and 2) the conditioned reinforcer effects of neutral stimuli when the participant observed a peer play with neutral stimuli. Four males educationally classified with autism spectrum disorder and speech and language impairments participated in Experiment 2. Post-intervention data suggest that neutral stimuli (metal washers, s-hooks, spoon shelf supports) became conditioned reinforcers during the individual and peer reinforcer assessments as a function of the

intervention for all 4 participants. Responses to denial of non-preferred stimuli delivered to a peer (conditioned reinforcement by observation), observational performance, and observational acquisition of new operant responses increased across all 4 participants who did not respond during pre-intervention probes. The results of both experiments suggest that a single intervention can establish all three types of observational learning. The results from Experiment 2 confirm that conditioned reinforcement by observation is a verbal behavior developmental cusp.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

I would like to thank everyone that has supported me on my journey towards reaching my dream. I could not have done this without each and everyone of you cheering me on throughout this journey. I am blessed to have such an amazing support system of family, friends, mentors, and co-workers that have helped shape me into the person I am today.

First, I would like to thank my incredible family. Without your love, wisdom, laughs, and constant pep talks I wouldn't have made the leap of faith to pursue my dream. To my amazing mother, you've always instilled in me to march to the rhythm of my own beat and to always follow my dreams. I cannot thank you enough for raising me to be a strong, independent female. You were always there to listen, give tough love when I needed it, make me laugh, or to just give me a hug and a kiss. Dad- our daily chats and check-ins helped keep everything in perspective whenever I felt like I had the weight of the world on my shoulders you'd simply tell me "non-carbardom illegenti" and everything would begin to make sense again. No matter how many times life didn't go the way that I thought it would you would always tell me "we don't fall, we bounce baby".

To my smarty-pants brother, Bernard, the original Dr. Lanter, I'm glad I finally get to join the club. To say I hit the jackpot for a brother would be an understatement. You always knew what to say or do to put a smile on my face. You are wise beyond your years and I am so lucky to have a brother and best friend like you. To my Aunt Maryke, you are the bedrock of our family and we'd all be lost without you. You have been such an inspiration and a role model to look up to throughout my entire life. You've taught me

that life is always an adventure and to enjoy the ride. To my Aunt Colleen my "LDGM" and study buddy for life. Thank you for your unconditional positivity, love, support and of course Gilmore Girl marathons. You are my beacon of light.

To my incredible, loving, amazing, husband, Jimmy, I cannot begin to put into words what your constant support has meant to me throughout this journey. You have always been my number one fan. You've lifted me up when I wanted to quit, made me laugh when I took life too seriously (which was often), listened when I needed to vent, and wiped my tears away when I needed to cry. During the high highs and the low lows you always made me feel like the most important person in the world and that together we could get through anything. Thank you for loving me unconditionally.

To the Stewart family, thank you Jim, Kim, Katie and Drew for welcoming me with open arms and supporting me throughout my schooling. I am so blessed to have you all my life.

To my best friends, Fallon, Nelcy and Laura thank you for being the most amazing friends a girl could ask for. Fallon- we are not just best friends but sisters. We've been through it all-literally, and there is no other person I'd want to have right by my side. Thank you for always listening, telling me to "do the right thing", going on adventures, and sending me daily Taylor pictures and videos when I needed to smile and laugh. Nelcy- you are one of the most hardworking, determined, sweetest and hilarious woman I've ever met and so proud that I get to call you one of my best friends. I am so honored to be Joey's God Mama and I love watching him grow and learn. Dr. Laura- WE DID IT! I honestly never thought the day would come but all of our hard work, determination, and some escape behavior here and there we both were able to achieve our

dreams. I am so glad we randomly sat next to each other seven years ago and from that first moment decided that we were lifers.

To my BOCES/CABAS family, thank you from the bottom of my heart for all of your love, guidance and support throughout my tenure. To Shahad- my taskmaster, I couldn't of asked for a better person to teach next door to me then you. You were always there with a smile on your face when I needed someone to brain storm with me, or just give me a hug when I needed it most. To Yasmin and Reggie, you have been the best mentors a girl could ask for. Yasmin, your guidance and wisdom throughout this journey helped me become the educator I am today. Reggie- I would of quit a long time ago if it wasn't for your constant support, advice, and laughs. You always helped keep things into perspective and motivated me throughout this journey. To all 13 of my CABAS mentees, thank you for providing so much love and support to all of my students throughout the years. To the rest of my BOCES family-Thank you for being such strong, intelligent, fierce women- you are all an inspiration.

Thank you to my dissertation committee: Dr. Dudek, Dr. Greer, Dr. Jahromi, Dr. Brassard, and Dr. Pohl thank you for all of your time and feedback throughout this process. It has been an honor and privilege to learn from you.

Dr. Greer thank you for your support, guidance and sometimes "tough love". You never let me settle for mediocrity and always pushed me to be not only a better student and writer but also a better behaviorist.

To Dr. Jessica Singer-Dudek, there are no words that would even come close to express how thankful, honored, and blessed I am to not only have you as my mentor, but as a friend. Thank you for all of your support, words of wisdom and encouragement,

motivation, and laughs over the last seven years. You have been such a positive role model and have paved the road of what a female research scientist can be. But above all, thank you for always believing in me and pushing me when I didn't believe in myself and wanted to give up, I am forever grateful.

DEDICATION

I dedicate this work to my mother, Karine D. Petruzzi, as she has dedicated her life to my brother and I, and our education. Thank you mom, for teaching me to always follow my dreams and although Cinderella's glass slipper is great, I was destined to shatter glass ceilings.

Chapter I

INTRODUCTION AND REVIEW OF THE LITERATURE

Introduction

One's phylogenic and ontogenic history plays vital roles in acquiring conditioned reinforcers. Several research studies have identified a type of observational learning (OL) where novel conditioned reinforcers are acquired through observation (Baowaidan, 2016; Byers, 2016; Eby & Greer, 2017; Greer & Singer-Dudek, 2008; Oblak, Greer, & Singer-Dudek, 2015; Sales, 1998; Singer-Dudek, Choi, & Lyons, 2013; Singer-Dudek & Oblak, 2013; Singer-Dudek, Oblak, & Greer, 2011; Zirino & Greer, 2013). This occurs when a previously neutral stimulus becomes a conditioned reinforcer after an individual observes stimuli given to another individual model while the individual is denied access. These studies demonstrated observational learning in students who had disabilities as well as students who did not have disabilities (Dudek & Oblak, 2013; Greer, Dorow, Williams, McCorkle, & Asnes, 1991; Greer & Dudek, 2008; Greer, Singer-Dudek, Longano, & Zrinzo, 2008; Schmelzkopf, Greer, Singer-Dudek, & Du, 2017). In the aforementioned studies, previously neutral stimuli, including rubber bands, metal washers, cotton swabs, toothpicks, books, non-preferred food items and vocal praise, became conditioned reinforcers for students after they observed their peers receiving reinforcement in those forms.

A program of research related to *Verbal Behavior Development Theory,* (VBDT) an extension of Skinner's *Verbal Behavior* (1957), identified different verbal behavioral developmental cusps and cusps that are also capabilities throughout a child's language development (Greer & Ross, 2008). A verbal behavior cusp allows a child to come into contact with new contingencies (Rosales-Ruiz & Baer, 1996). A cusp that is also a capability is a higher-order operant that allows the learner to acquire novel material, learn novel material without

direct instruction, and learn in new ways, such as through indirect contact with contingencies (Greer & Du, 2015; Greer & Longano, 2010; Greer & Ross, 2008; Greer & Speckman, 2009).

Observational Learning (OL) is a verbal behavior developmental cusp that is also a capability because children are able to learn new operants or new reinforcers without direction instruction (Greer & Ross, 2008; Greer & Speckman, 2009). Greer, Singer-Dudek, and Gautreaux (2006) suggested that there are three types of observational learning cusps: 1) conditioned reinforcement by observation, 2) observational performance (OP) and 3) observational learning (OL).

When conditioned reinforcement by observation is demonstrated neutral stimuli are conditioned as reinforcers without direct instruction. This occurs when a neutral stimulus becomes a conditioned reinforcer after an individual is denied access to the stimuli while observing a consequence involving that stimulus given to another individual. Observational performance is demonstrated when an individual emits a behavior that is already in one's repertoire as a result of observing another peer receive reinforcement (e.g., great job) or a consequence (e.g., "please don't do that"). Observational learning is demonstrated when an individual is able to learn something entirely new/novel without direct instruction. The individual is able to observe another peer in his/her environment emit a response and receive a consequence (Greer et al., 2006).

These three types of OL have been studied separately in prior research studies but have only have found the relations between one or two types of OL (Byers, 2016; Eby & Greer, 2017; Gold, 2013; Greer & Dudek, 2008; Greer et al., 2008; Katz, 2017; Oblak et al., 2015; Sales, 1998; Singer-Dudek & Oblak, 2013; Singer-Dudek et al., 2011; Singer-Dudek et al., 2013; Zrino & Greer, 2013) No prior study has tested the effects of an observational conditioning-by-denial intervention on all three types of OL simultaneously. The overall purpose of Experiment 1 was to

determine if an observational conditioning-by-denial intervention would lead to the establishment of conditioned reinforcement by observation, OP, and OL.

I first established that neutral stimuli (binder clips) did not function as conditioned reinforcers for a mastered task and three learning tasks for participants. I then established that conditioned reinforcement by observation observational performance (OP), and observational acquisition of new operants (OL) was missing for participants. I then implemented an observational conditioning by denial intervention where participants observed a peer receive neutral stimuli for every response the peer emitted (correct or incorrect) while the participants were denied access to the neutral stimuli. Once participants verbally requested and/or physically attempted to gain access to the neutral stimuli one or more times across two consecutive sessions, participants were delivered the original mastered task and learning tasks to see if neutral stimuli (binder clips) had become a conditioned reinforcer. Following the reinforcer assessment, post probes were conducted to see if conditioned reinforcement by observation, OP, and OL were established as a result of the intervention.

The purpose of Experiment 2 was to determine if conditioned reinforcement by observation is a verbal behavior developmental cusp. By definition, if the child is able to acquire new conditioned reinforcers by observation, when he/she could not before an intervention, conditioned reinforcement by observation can be confirmed as a cusp. A *cusp* is induced when an individual is able to learn new things he could not before and/or learn novel material at a faster rate (Greer & Ross, 2008; Rosales-Ruiz & Bear, 1996). I first established that conditioned reinforcement by observation was missing for participants. Each time a participant earned all of his or her tokens, he or she was able to "trade in" his tokens for a known reinforcer or a neutral stimulus. Participants earned their tokens by following classroom directions and emitting correct responses. Each participant's reinforcers were different based on their individual wants. For

example, some participants earned all of their tokens to gain access to play with trains, MagnaTiles®, or action figures for a specified amount of time. Each time a participant earned all of his/her tokens the participant, was able to trade in for a variety of items (known conditioned reinforcer or a neutral stimulus). Data were collected for ten consecutive opportunities across each participant. Following the 10 consecutive opportunities the participant then observed a peer trade in for one of the three neutral stimuli for 60 s, and then was given the choice to trade in for a known conditioned reinforcer or a neutral stimulus. Data were collected for ten consecutive opportunities across each participant.

I then established that conditioned reinforcement by observation, observational performance, and observational acquisition of new operants were missing for participants. Following the three OL probes, I implemented an observational conditioning-by-denial intervention where participants observed a peer receive neutral stimuli, (different from the stimuli used in the individual and peer reinforcer assessments) for every response the peer emitted (correct or incorrect) while the participants were denied access to the neutral stimuli. Following the intervention, post-probes were conducted to see if conditioned reinforcement by observation was established. In addition, post-probes were conducted to see if OP and OL were established as a result of the intervention.

The review of the literature will address three key areas of research and theory that are related to the acquisition of new reinforcers. I will include discussions of 1) conditioned reinforcement as a principle of behavior, 2) conditioned reinforcement by observation, and 3) conditioned reinforcement from a verbal behavior development perspective. I will present an extensive review of literature of related terms, as well as the implications of the acquisition of conditioned reinforcement by observation in both human and non-human subjects.

Review of the Literature

Conditioned Reinforcement- a Principle of Behavior

Behavior analysts have always been interested in the principle of conditioned reinforcement, more specifically, how stimuli become conditioned reinforcers (Kelleher & Gollub, 1962; Skinner, 1938, 1968; Williams, 1994). One theory is that neutral stimuli are conditioned as reinforcers through pairings with established (primary) reinforcers. Pairings can occur immediately after or simultaneously with the response, as in classical or respondent conditioning (Hull, 1943; Pavlov, 1927). In operant conditioning, pairings occur contingent upon a response(s). Each response becomes a subsequent operant for the next, thus becoming a discriminative stimulus that is also a conditioned reinforcer (Kelleher & Gollub, 1962; Keller & Schoenfeld, 1950; Skinner, 1938).

Discriminative stimulus hypothesis. According to Skinner (1938) the concept of conditioned reinforcement is closely related to the concept of chaining. Skinner's Law argued that chaining of respondent and operant behavior occurs when "the response of one reflex may constitute or produce the eliciting or discriminative stimulus of another" (Skinner, 1938 p. 32). A *discriminative stimulus* is defined as a "stimulus in the presence of which an operant response is reinforced" (Kelleher & Gollub, 1962, p. 544). When operants become conditioned reinforcers, a chain is established. For example, when training food-deprived rats to press on magazine levers to receive a pellet of food, the first step is magazine training. Magazine training established a complex chain of responses that consist of operant and respondent responses.

Schoenfeld, Antonitis, and Bersh (1950) conditioned rats to walk into the cage's food tray when they heard the sound of a food pellet falling into the tray. Skinner (1938) theorized that conditioned reinforcement was explained by analyzing chains of discriminated operants. Skinner

(1938) argued that in every link of operant chains, the discriminative stimulus serves both as a subsequent operant and acts as a conditioned reinforcer for the operant that precedes it.

Keller and Schoenfeld (1950) expanded on Skinner's theory and developed the Discriminative Stimulus Hypothesis. The Discriminative Stimulus Hypothesis suggested that conditioned reinforcers can always be discriminative stimuli and discriminative stimuli are conditioned reinforcers (Keller & Schoenfeld, 1950). Keller and Schoenfeld (1950) further expanded Skinner's description of conditioned reinforcement: a "stimulus, which is not originally a reinforcing one (or which is not, as we often say a "primary reinforcer") can become reinforcing through repeated association with one that is. That is, reinforcing effects may be acquired by a stimulus through being present when an original reinforcement is given" (p. 234).

Schoenfeld et al. (1950) suggested that in order to act as a conditioned reinforcer (S^r) for a response, a stimulus must be a discriminative stimulus (S^D) for the same response. They proposed three steps: 1) training conditions to obtain an S^r are identical to the conditions to obtain a S^D, 2) the response that is specifically used as an S^D is not the only way it can be used as an S^r, and 3) the S^D and S^r are interchanged, and the interchange of stimulus function does not produce any differences in performance (Dinsmoor, 1950). For example, Skinner trained rats to come to a tray for a food pellet when they heard the sound of the magazine lever. The bar and the sound of the lever press were first introduced to the rats, the pressing behavior was conditioned by the magazine lever sound, which was produced by the rat. Thus, the stimulus acts as both an S^D and an S^r.

Kelleher and Gollub (1962) conducted an extensive review that systematically tested chained schedules of reinforcement on the basic origins of conditioned reinforcement within behavior analysis. In their review they addressed three major questions: 1) what are the necessary conditions for a stimulus to become a conditioned reinforcer?, 2) what variables contribute to the

strength of conditioned reinforcers?, and 3) what are the future research applications for conditioned reinforcement? Kelleher and Gollub (1962) found that any stimulus (aversive or neutral) can become a conditioned reinforcer. Conditioned reinforcer strength depends directly on the 1) immediacy and 2) frequency of pairings between the stimuli and a known reinforcer. Furthermore, Kelleher and Gollub's (1962) findings suggested that it was understood how conditioned reinforcers were acquired, and how to test for conditioned reinforcers, but its utility in explaining other behavioral phenomena such as learned reinforcers was still a critical area of research. Moreover, much of their research was limited to non-human animals (primates).

Donahoe and Palmer (2004) found that infants as young as ten days old would blink in response to a tone that was followed by a puff of air. As these trials continued the infants began to blink following the tone. The results align with Keller and Schoenfeld's (1950) Discriminative Stimulus Hypothesis suggesting that the tone was both a S^D and a conditioned reinforcer. Donahoe and Palmer (2004) suggested that one's initial experience with his/her environment leads to the acquisition of conditioned reinforcement. They also argue that every person is born with a set of unconditioned reinforcers and respondent behaviors, which respond to eliciting stimuli. Lastly, they suggested that one's experience with his/her environment allows other stimuli to become conditioned reinforcers.

Stimulus-Stimulus pairing hypothesis. Other researchers attributed a stimulus-stimulus pairing procedure to condition a neutral stimulus as a conditioned reinforcer (Gollub, 1970; Williams, 1994; Zimmerman, Hanford & Brown, 1967). Conditioned reinforcement involves a response-dependent presentation of a stimulus for a short period of time, while in the presence of another conditioned or unconditioned reinforcer (Williams, 1994). According to Williams (1994) this is a conditioned value or "the idea that stimuli paired with primary reinforcers acquire reinforcement properties in their own right" (p. 547).

Zimmerman conducted a series of experiments that supported William's conditioned value hypothesis. Zimmerman et al. (1967) presented food to pigeons on a 3 min variable time (VT) schedule. Different frequencies of the conditioned reinforcers (brief periods of the darkened response key, the extinction of the house light, and the sound of a food tray) were presented throughout all experimental conditions. The authors found that when primary reinforcement was suspended, pecking rates were maintained, suggesting that schedules of conditioned reinforcement can continuously maintain a behavior(s), similar to what occurs with primary reinforcement (Gollub, 1970; Zimmerman et al., 1967).

There have been several applied studies that have successfully implemented a stimulus-stimulus pairing procedure to expand individuals' community of reinforcers. Cotter and Spradlin (1971) and Greer (1980) conditioned music preferences. Miguel, Carr, and Michael (2002) and Sundberg, Michael, Partington, and Sundberg (1996) conditioned novel vocal verbal behavior. In addition, books, toys, worksheets, 2D stimuli, adult faces, and adult voices have all been conditioned as a result of a stimulus-stimulus pairing procedure (Du, Borto, & Greer, 2015; Greer, Becker, Saxe, & Mirabella, 1985; Greer, Pistoljevic, Cahill, & Du, 2011; Longano & Greer, 2006; Maffei, Singer-Dudek, & Koehane, 2014; Nuzzolo-Gomez, Leonard, Rivera, & Greer, 2002; Pereira-Delgado, Greer, Speckman, & Goswami, 2009; Tsai & Greer, 2006). Stimulus-stimulus pairings require multiple sessions, which can be time consuming, and in some studies unsuccessful, in conditioning new reinforcers (Miguel, Carr, & Michael, 2002; Nuzzolo-Gomez et al., 2002; Yoon & Bennett, 2000). Moreover, the effectiveness of conditioned reinforcers is supported by empirical research across a variety of applications (Du et al., 2015; Greer et al., 1985; Greer et al., 2011; Longano & Greer, 2006; Maffei et al., 2014; Nuzzolo-Gomez et al., 2002; Pereira-Delgado et al., 2009; Tsai & Greer, 2006). It is likely that similar

pairings occur during observational conditioning procedures but a stimulus-stimulus pairing procedure has not been used to establish any type of OL.

Conditioned Reinforcement from Observation

In the following sections I discuss two different perspectives: comparative psychology and social psychology, to further understand the acquisition of new conditioned reinforcers. Wykoff (1952, 1969) found that human and non-human species' (pigeons and rats) behavior can be maintained through conditioned reinforcers. He also found that when organisms observed stimuli, their observing responses did not have a direct effect on the schedules of reinforcement. The results of Wykoff's (1952, 1969) studies found that behavior(s) can be maintained through conditioned reinforcers. Dinsmoor (1977) developed the conditioned reinforcement hypothesis of observing. According to Fantino (2008) this occurs when an individual observes a stimulus that has already been paired with immediate reinforcement, thus becoming a conditioned reinforcer. A stimulus that has been paired with a smaller amount of reinforcement and/or delays in reinforcement will less likely function as a conditioned reinforcer. Therefore, the immediacy and frequency of reinforcement will either decrease or maintain observing responses (Fantino, 2008; Williams, 1994; Wykoff, 1952, 1969).

Observational learning (OL). There have been several studies that have examined copying or imitation in non-human animals, including blackbirds (Curio, Ernest, & Vieth, 1978), pigeons (Epstein, 1984), rhesus monkeys (Cook, Mineka, Wolkstein, & Laitsch, 1998; Mineka & Cook, 1988), and female guppies (Dugatkin & Godin, 1992). Curio et al. (1973) found that blackbirds acquired escape responses to friarbirds, which are not natural predators, when blackbirds observed a conspecific escaping from a friarbird. Epstein (1984) found that pigeons began to engage in novel behavior (putting their heads in a noose) as a function of observing conspecies peers receive food as a reinforcer after placing their heads in a noose. Curio et al.

(1973) and Epstien's (1984) findings suggest that copying and observing behaviors of other individuals allow birds to survive by being able to escape a dangerous situation(s) or access food.

Dugatkin and Godin (1992) found that female guppies, who are genetically predisposed to select male guppies with bright colored scales, pursued and mated with dull-colored males after observing other female guppies that appeared to mate with dull colored male guppies. Dugatkin and Godin (1992) designed a mirror system, where it only appeared that female guppies picked a dull colored male to mate with. Several studies expanded upon and replicated these results (Dugatkin, 1996a, 1996b; Dugatkin and Godin, 1993, 1998; Godin, Herdman, & Dugatkin, 2005). Godin et al. (2005) conducted a follow up study to examine if changes in mate selection were maintained over time. The results suggested that female guppies' preference to mate with dull colored males. Thus, because of female guppies learned new reinforcers in mate preference this resulted in changing their phenotypic mate preference, which had epigenetic influences.

Galef and White (2000) found that female Japanese quails pursued and mated with non-preferred males after observing a female pursue and mate with a non-preferred male. However, if the female did not observe another female, the female's behavior did not change. Godin et al. (2005) argue that social mating preferences are significant because preference traits (male or female) can be passed through natural selection, which can affect the ontogeny and phylogeny of traits across future generations. Greer and Singer-Dudek (2008) argued that mate choice was about conditioned reinforcement.

The studies mentioned above are relevant to Greer, Singer-Dudek and colleagues' research on human acquisition of new reinforcers because the findings show that other non-human species can acquire new reinforcers through observation. In addition, the newly acquired reinforcers are not momentary changes, like those produced by establishing operations, but are

maintained over time. Moreover, these findings suggest that acquiring new conditioned reinforcers via observation may have evolutionary advantages and implications in natural selection (Dawrin, 1860, as cited by Kelleher and Gollub, 1962).

Mate Poaching in Humans and Mate Copying

Social psychology studies that examined mate poaching, mate copying, and perceived attractiveness are the closest approximation to studying mate selection in humans. Schmitt (2004) and Schmitt and Buss (2001) define mate poaching as a cross-cultural preference for pursuing a female or male who is already attached. Parker and Buckley (2009) investigated whether ones gender engaged in mate poaching more than the other. They found that single women were more interested in men who were already attached to another individual. They also found no differences in women and men who were in committed relationships. Additionally, one's attractiveness was not correlated with mate poaching. It is possible that mate poaching occurs because of denial. It is also possible that the "good ones" are taken. Single woman are more interested in married men because they are denied opportunities to form a relationship with them.

Graziano, Jensen-Campbell, Shebilske, and Lungren (1993) found that women's attractiveness ratings of men were influenced by their peer's attractiveness rating. Similarly, Eva and Wood (2006) found when women were shown pictures of married men, women rated them to be more attractive than single men. Mate poaching and mate copying may be a reproductive application of the ability to acquire new conditioned reinforcers through observation; however, there are also other factors, such as denial, that contribute to this phenomenon.

Human Clothing and Body Decoration

In addition to mate selection, another possible way humans can acquire conditioned reinfocers through observation is through clothing and body decoration. Humans are the only

species that wear clothing (Cartensen, 2013). Picking out and wearing clothing is a social phenomenon that is uniquely human (Cartensen, 2013; Tomasello, 2008). According to Cartensen's (2013) theory human beings began to adapt by wearing clothing following the loss of body hair. Humans during the ice age may have started to wear clothing to keep warm whereas Neanderthals did not adapt to the cooler temperatures with clothing. This may have been a contributing factor in their extinction. Thus, human clothing not only became an evolutionary advantage, it also became a social one; before wearing clothing to keep warm, humans decorated their bodies with paint and/or prehistoric jewelry. Human decoration can be a display of social status and wealth (Cartensen, 2013).

Body adornment differs in humans than animals who engage in adornment as a part of a mating ritual such as peacocks and crabs, but it may not be completely unrelated (Cartensen, 2013). Mating and courtship are types of social behaviors. One's clothing may show off his/her features and assets that a potential mate may find desirable. Similarly, in mate copying, individuals quickly assess for paternal ability, whereas clothing and body decoration enhances human physical capabilities (i.e., wearing a coat in the winter to keep warm) and shared intentions about wealth, reinforcer preferences, and social status. Body adornment and human clothing are prevalent in current society and culture. Most, if not all, fashion brands are constantly introducing new fashion fads and trends to specific age groups of men and woman. When a new item and/or fad becomes a "popular/must have" that item becomes a conditioned reinforcer. Individuals who are specifically targeted by advertisers will want to gain access to that item if they are able to observe their peers gain access to the item and they do not yet have it. Therefore, human clothing trends and fads can result in the acquisition of conditioned reinforcers by observation.

Verbal Behavior Development Theory (VBDT) of Conditioned Reinforcement

Much of the behavior analytic work from the first half of the twentieth century focused on studying schedules of reinforcement, stimulus-stimulus pairing procedures, conditioned reinforcement, and understanding how neutral stimuli became conditioned reinforcers and, in turn, how they affected learning (Kelleher & Gollub, 1962; Keller & Schoenfeld, 1950; Pavlov, 1906; Skinner, 1938; 1953; Thorndike, 1911; Williams, 1994). However, the topic fell out of favor for many years in the research community for many reasons. During the 1980's, behavioral research declined in its popularity due to the "birth" of the cognitive revolution, which focused on the cognitive perspective for explaining behavior in humans. In addition, the research community assumed conditioned reinforcement was largely understood and no new research was needed (Kelleher & Gollub, 1962; Keller & Schoenfeld, 1950; Pavlov, 1906; Skinner, 1938; 1953; Thorndike, 1911; Williams, 1994). Although there was a great deal of research outlining the protocols and procedures to test for conditioned reinforcers, the research lacked explanations for other behavioral phenomena, such as how reinforcers are learned. Third, there was a disagreement among behaviorists about the utility and legitimacy of conditioned reinforcement as an explanation of certain behavioral phenomena. Lastly, the research on conditioned reinforcers was restricted to a few primate species and non-human animals.

Verbal Behavior Development Theory (VBDT) suggests that conditioned reinforcers are the "foundational base" for most verbal behavior developmental cusps, and cusps that are also capabilities in humans (Greer & Du, 2015). Moreover, learned reinforcers are critical to understanding what a person can do. VBDT (Greer & Ross, 2008) includes empirical and theoretical findings suggesting that conditioned reinforcement may be a source for the development of higher-order operants (Greer & Du, 2015).

Verbal Behavior Development Theory identifies different cusps and cusps that are also capabilities throughout a child's language development: 1) Generalized Imitation (GI), 2) Naming, and 3) Observational Learning (OL) (Greer & Ross, 2008). A verbal behavior developmental cusp allows a child to come into contact with new contingencies (Rosales-Ruiz & Bear, 1996), resulting in the child learning new things and/or learning at faster rates. A verbal behavior developmental cusp that is also a capability is a higher order operant that allows the learner to acquire novel material in new ways, and learn novel material without direct instruction (Rosales-Ruiz & Baer, 1996). In addition, when children acquire a cusp that is also a capability, such as Naming and OL, the child comes into contact with new environmental contingencies and can learn through indirect contact with contingencies indirectly (Greer & Ross, 2008; Greer 2009; Greer & Speckman, 2009; Rosales-Ruiz & Baer, 1996). Naming and OL are developmental cusps that are also capabilities because children are able to learn new operants without direct instruction (Greer & Ross, 2008; Greer & Speckman, 2009). Once a child acquires Naming and OL he/she will be able to learn from incidental or indirect contact with environmental contingencies that further expand his/her verbal behavior (Greer, 2009; Greer & Longano, 2010; Greer & Speckman, 2009).

VBDT proposes that one's initial key experiences are the result of foundational verbal behavior developmental cusps, allowing more complex behavior(s) to develop. When a new verbal behavior developmental cusp is in repertoire for an individual it is because new conditioned reinforcers have been established. The acquisition of new conditioned reinforcers allows individuals to emit more social and complex behavior (Greer & Du, 2015). Establishing new conditioned reinforcers allows the reinforcing consequences of behaviors to pull along the necessary associated motivating operations and antecedent control to develop complex social behaviors (Greer & Du, 2015). Greer and Du (2015) propose that this is a critical piece in the

verbal behavior developmental model, as it addressed the criticisms of the behavior analytic description of complex human behaviors such as OL.

Within the VBDT trajectory, there are several cusps that an individual needs prior to being able to establish verbal behavior development cusps that are also capabilities. Many children educationally classified with a developmental disability are missing these vital cusps, and as a result they require interventions to condition adult voices and faces through pairings with a known reinforcer (Greer, 2008; Greer & Keohane, 2005; Greer & Ross; 2008; Keohane, Luke, & Greer, 2008. Once children have conditioned reinforcement for early observing responses, they can become listeners.

Listener and Speaker. Once an individual has early observing responses, he/she can begin to contact new environmental contingencies and learn in new ways, by listening (Greer & Keohane, 2005; Keohane et al., 2008). According to Skinner (1957), listening is a verbal response that is shaped by the speaker's behavior. Initially the listener and speaker topographies develop separately and function independently of each other during initial language development (Skinner, 1957; Horne & Lowe, 1996). Before children learn to speak they are already listeners (Skinner, 1957; Greer, 2009; Greer & Ross, 2008). Young children are able to discriminate between preferred faces and voices (Greer et al., 2011; Horne & Lowe, 1996; Keohane et al., 2008; Maffei et al., 2014; Pereira Delgado et al., 2009). The fusion of the listener and speaker topographies continues as caregivers label items in front of their children as well as point to and tact novel stimuli (Greer, 2009; Greer & Ross, 2008; Horne & Lowe, 1996; Skinner, 1957). As individuals come into contact with different environmental and cultural contingencies the listener and speaker functions join (Greer, 2009; Greer & Ross, 2008; Horne & Lowe, 1996; Skinner, 1957).

Bidirectional Naming (BiN)- A Behavioral Capability

Bidirectional Naming (BiN) is a verbal behavior developmental capability that children acquire over the course of their development (Horne & Lowe, 1996). They are not hardwired with this capability (Horne & Lowe, 1996). Horne and Lowe (1996) built on Skinner's (1957) *Verbal Behavior Theory* and introduced "Naming" as a key verbal behavior developmental stage. Naming is a built-in bi-directional operant "speaker-listener" relation. When individuals have Naming they are able to be "truly verbal" for the first times in their lives (Greer & Longano, 2010; Greer & Ross, 2008; Greer & Speckman, 2009; Rosales-Ruiz & Bear, 1996). When the listener and speaker functions are joined an individual can speak to someone (a listener) and simultaneously act as a listener and, vice versa, an individual can be a listener and respond as a speaker (Barnes, 2001; Greer, 2009). Naming in its simplest definition is how individuals learn language incidentally (Horne & Lowe, 1996). In order for an individual to be "truly verbal" the speaker must act as his own listener (Skinner, 1957). When children have BiN they are able to acquire novel language without direct instruction (Horne & Lowe, 1996; Greer, 2009; Greer & Speckman, 2009). Students with disabilities often are missing this verbal behavior developmental cusp that is also a capability and require an intervention to induce BiN. Greer and Ross (2008) have expanded upon Horne and Lowe's (1996) seminal research with their *Verbal Behavior Development Theory,* explaining how the acquisition of BiN is the fusion of the listener and speaker function.

Several studies have successfully induced BiN in children who did not demonstrate it prior. Children with native disabilities may have acquired unidirectional Naming (UiN) (e.g., they are able to match and point to stimuli across various settings) but when shown an item they are not able to vocally produce the correct response. In addition, some children may have the speaker response where they are able to tact/identify items but when asked to match or point to

items they are unable to acquire this behavior without direct instruction. Once BiN is induced, children do not need direct instruction but can now learn from contacting their environment in ways they did not before (e.g., through observation) (Fiorile & Greer, 2007; Greer, Chavez-Brown, Nirgudkar, Rivera-Valdes, 2005; Greer, 2002; Greer & Keohane, 2005; Greer & Longano, 2010; Greer & Ross, 2008; Greer & Speckman, 2009; Pistoljevic, 2008; Pistoljevic & Greer, 2006).

The acquisition of BiN is a key cusp that is also a capability that allows an individual to contact his/her environment and learn without direct instruction. Children who have the BiN capability are able to expand their language acquisition at an accelerated rate compared to children who are missing the listener or speaker half of Naming or for whom the two are not joined. BiN is one of three verbal behavior development capabilities. The next one I will discuss is observational learning (OL). Just as there are initially separate distinct repertories associated with BiN, OL has three distinct types.

Observational Learning (OL)

OL is a cusp that is also a capability, which allows the individual to learn indirectly from observing other individuals in his/her environment receive reinforcement and/or corrections (Greer et al., 2006; Greer & Singer-Dudek, 2008). It is a crucial cusp that leads to new ways of learning for individuals (Byers, 2016; Davis-Lackey, 2005; Gold, 2013; Greer & Singer-Dudek, 2008; Greer et al., 2006; Reilly-Lawson & Walsh, 2007; Rothestein & Gautreaux, 2007; Stolfi, 2005). Children who are educationally classified with intellectual disabilities tend to need to have this cusp that is a capability induced (Greer, 2002; Greer & Ross, 2008; Greer & Speckman, 2009).

Catania (1998) defined learning as "a behavior added to an organism's repertory; a relatively permanent change in behavior" (p 17). Catania (1998) further defined OL as "learning based on observing the responding of another organism (and/or its consequences)" (p. 227).

Bandura's (1977) early research on vicarious learning/OL was similar to Catania's (1998) definition of OL. Bandura (1977) suggested that vicarious learning was a product of modeling, punishment/reinforcement, and reward. Bandura (1977) identified three types of OL: 1) live model, 2) verbal model, and 3) symbolic model. A "live model" is when an individual observes a live model exhibiting a specific target behavior. A "verbal model "occurs when the individual can only hear the model speak about the specific target behavior. Lastly, a "symbolic model" is when an individual watches a video of a model performing the target behavior.

Deguchi (1984) analyzed the critical role radical behaviorism had in explaining and describing modeled behavior that occurs later in time. Deguchi (1984) identified three characteristics of observational learning outlined in social learning theory from a radical behaviorist perspective: 1) observed consequences, 2) one-trial learning, and 3) delayed performance. In observed consequences, the model's behavior is consequated. Social learning theorists propose that vicarious reinforcement plays a role whereas behaviorists suggest when an individual observes a model and it's consequence (vicarious reinforcement), it functions as an S^D for imitating the target behavior. One-trial learning is when an individual imitates a new behavior after a single exposure to the model without direct prompting or external reinforcement. Social learning theorists suggest that the new behavior is acquired as a result of cognitive processes of observation whereas a radical behaviorist identifies one's history of reinforcement for imitation. Lastly, delayed performance is when a behavior that was modeled previously and not imitated is emitted later on without the model. According to social learning theory, delayed

performance is explained through cognitive mediation whereas radical behaviorists suggest that these processes are mediated though behavior beneath one's skin.

Greer, et al. (2006) and Greer and Singer-Dudek (2008) identified three types of observational learning that have been reported in the literature: 1) conditioned reinforcement by observation, 2) observational performance (OP), and 3) observational acquisition of new operants (also known as observational learning) (OL) (Gold, 2013; Greer & Dudek, 2008; Greer et al., 2006; Singer-Dudek et al., 2013; Singer-Dudek & Oblak, 2013; Stolfi, 2005).

Three types of Observational Learning

Conditioned Reinforcement by Observation. This type of observational learning, and the most relevant to the present study, is conditioned reinforcement by observation. Greer and Dudek (2008) suggest that new conditioned reinforcers will emerge as a result of observation under certain denial conditions. This occurs when a neutral stimulus becomes a conditioned reinforcer after an individual observes a consequence involving that stimulus being given to another individual (Byers, 2016; Eby & Greer, 2017; Gold, 2013; Greer et al., 1991; Greer & Dudek, 2008; Greer et al., 2008; Katz, 2017; Oblak et al., 2015; Sales, 1998; Singer-Dudek et al., 2011; Singer-Dudek, et al., 2013; Dudek & Oblak, 2013; Zrino & Greer, 2013).

Observational Performance (OP). The second type of observational learning is observational performance. Catiana (2008) makes the distinction between acquiring new operants and performance behaviors. Performance behaviors are behaviors in repertoire that are emitted as a result of observing a model's consequence (Greer, 2002; Greer et al., 2006; Greer, & Singer-Dudek, 2008). Performance behavior is different than imitation, because with imitation the reinforcer is the correspondence between the model and the observer's behavior. If a child changes his behavior to emit a behavior that is already in his repertoire, due to observing another child receiving reinforcement (positive or negative), the child is not directly accessing the

contingencies of reinforcement, however, he is modifying his behaviors to match the present contingencies.

Acquisition of new operants and induction of a new capability (OL). Acquisition of new and high-order operants occurs when a student is able to learn something entirely new without direct instruction, after observing someone else in his/her environment emit a response and receive a consequence (Greer et al., 2006). This type of observational learning is crucial for students to have in order to be successful in a general education environment, wherein most instruction is delivered to a whole group instead of individual direct instruction. When a student acquires the ability to learn through observation, he/she is able to learn in a completely new way (Greer & Keohane, 2005; Greer et al., 2006; Greer & Ross, 2008).

Procedures that have been Successful in Establishing one or more types of OL.

The peer-yoked contingency, social listener reinforcement (SLR), and peer-competitive/observational interventions are successful intervention procedures to induce conditioned reinforcement by observation, OP, and OL (Baker, 2014; Baowaidan, 2016; Byers; 2016; Davies-Lackey, 2005; Singer-Dudek et al., 2013; Dudek & Oblak, 2011; Dudek & Oblak, 2013; Eby & Greer, 2017; Gold, 2013; Reilly-Lawson, 2007; Rothstein & Gautreaux, 2006; Sterkin 2012; Stolfi, 2005).

Peer-Yoked Contingency to Induce OL. A peer-yoked contingency is an effective intervention that has been demonstrated to induce OL (Beyers, 2016; Davies-Lackey, 2005; Gold, 2013; Rothestein & Gautreaux, 2007; Stolfi, 2005). A yoked contingency is "a condition in which children must work or learn together in order for both to receive reinforcement" (Greer & Ross, 2008, p. 304).

Stolfi (2005) studied the effects of a peer-yoked contingency game board on the emergence of OL. In her study, both participants were able to move up on their game board

when the target participant emitted a correct response to an observed learn unit. An observed learn unit was defined as the participant emitting the correct response after he/she observed his/her peer being directly taught and receiving reinforcement or a correction. When the participant emitted a correct response to an observed learn unit both the participant and peer moved up one space on the game board. For example, the target participant was able to observe his/her peer being directly taught and learn the novel information. When it was time for the target participant's turn to provide a response the target participant was able to correctly respond. If the participant emitted an incorrect observed learn unit the researcher moved up (i.e., the target participant was unable to observe and learn from the peer). The findings showed that a peer-yoked contingency was an effective intervention in inducing observational learning across participants because it created a motivating condition (EO) for participants for observe their peers (Stolfi, 2005).

Similarly, Davies-Lackey (2005) tested the effects of a peer-yoked contingency with a game board on the induction of observational learning with school-aged children educationally classified with developmental disabilities. Prior to the intervention all of the participants were missing OL in their repertoire. Participants were paired in dyads- one participant was the target, the other the confederate. A peer-yoked contingency game board was used to teach both participants novel math facts. The target participant was able to learn novel math facts by observing the confederate participant receive reinforcement for correct responses or corrections for incorrect responses. The results showed that a peer-yoked contingency game board induced OL across participants (Davies-Lackey, 2005).

Using a delayed multiple probe design across three male participants, Rothstein and Gautreaux (2007) tested the effects of a peer-yoked contingency game board on the induction of OL and full Naming. The authors found that after the implementation of the peer-yoked

contingency game board all three participants' correct responses to observed learn units increased during post probe sessions. The authors also found that Bidirectional Naming (BIN) emerged for two participants as a result of implementing a peer-yoked contingency game board (Rothstein & Gautreaux, 2007).

Gold (2013) tested the effects of a peer-yoked contingency game board on the acquisition OL, OP, and BIN in two experiments. In the first experiment, six children (one target participant and one peer participant) were paired into three dyads. The independent variable for both experiments was the peer-yoked contingency. By creating two paths, one for the participants (dyads) and one for the head researcher, she was able to motivate both of the participants to observe their fellow peer so they could move up on the game board. During the intervention the experimenter placed two identical scenery pictures in front of each child. The researcher placed three different types of stickers in front of each child. Once the peer participant placed a sticker on his/her picture the researcher delivered social praise to the peer participant. The target participant had 3-5 s to observe his/her peer and place the same sticker on his own scene in the same location as the peer. If the target participant did not observe his/her peer and place the sticker in the same location the researcher got to move up on the game board. If the target participant correctly observed his/her peer and placed the correct sticker in the exact location, both the target and peer participant moved up one space on the game board. In Experiment 1 a functional relationship occurred between the peer-yoked contingency intervention and the emergence of OL and OP, and the speaker component of Naming across target participants. In addition, OL and BIN emerged as a result of the peer-yoked contingency intervention across peer participants, who already had OP in repertoire. In Experiment 2, the researcher assessed the function of the peer-yoked contingency game board with eight participants. All four dyads entered a no-peer intervention first. During this condition, the peer met with the head researcher

first without the target participant present. The peer created the scene the same way the target participant did in Experiment 1, however upon completion of each sticker he/she moved up on the game board by him/herself. Once all ten stickers were on the peer picture, the target participant was called over. He/she sat at the table next to an empty chair in front of the scene the peer had created. The researcher then presented three stickers (same shape, 3 different colors) to the target participant to duplicate the peer's picture scene, who also moved up the game board following correct responses. The results showed that a peer was necessary to induce OP, OL, and the speaker component of Naming (Gold, 2013). Furthermore, Gold (2013) anecdotally found that emission of verbal operants increased across participants and peers as a result of the peer-yoked contingency.

Vassare (2017) tested the effects of a peer-monitoring procedure on two types of OL (OL and OP) across 12 preschoolers. Participants in both experiments were both typically developing and educationally classified with developmental delays. Prior to and following the peer-monitoring intervention all participants were assessed on their correct and incorrect responses to in-vivo OL and OP probes. In Experiment 1, all 12 participants were split into 6 matched pairs: one participant was assigned to the video condition and one assigned to the in-vivo condition. The peer-monitoring intervention was implemented in two stages: 1) a phase where participants monitored peer confederate responses that were already in their repertoire and 2) a phase where participants monitored responses that were novel and not in their repertoire. The results suggested that five out of six participants demonstrated OP after the intervention, and only participants who were assigned to the in-vivo condition demonstrated OL. Participants who were originally assigned to the video condition then entered the in-vivo condition. Following the completion of the in-vivo condition the participants demonstrated OL. In Experiment 2, the same procedures were used, however, Vassare (2017) conducted OL and OP probes in-vivo and in

video conditions. In addition, she also tested the effects of peer-monitoring on the emission of social contact in free play settings between experimental conditions. The results of Experiment 2 were consistent with the findings of Experiment 1, the video condition was not an effective intervention agent to induce OL but did induce OP across participants. In addition participants who were assigned to the in-vivo condition emitted higher numbers of social contact in free play settings than participants assigned to the video condition.

Byers (2016) tested the effects of a peer-yoked contingency game on all three types of OL across fourteen preschool-aged students. The participants in her study were both typically developing and educationally classified with developmental delays. Prior to the implementation of the peer-yoked contingency game board Byers tested for 1) peer attention, 2) OL, 3) OP, and 4) conditioned reinforcement by observation. The results of the pre-screening probes suggested that the participants fit into one of four groups based on peer attention and the three types of OL. The results showed that eight participants who demonstrated peer-awareness prior to the implementation of the yoked contingency game board were able to acquire all three types of OL after the intervention. Byers' (2016) results also suggest that peer awareness is a necessary prerequisite to acquire all three types of OL.

Peer-Yoked Contingency Game Boards to Increase Verbal Operants. Reilly-Lawson and Walsh (2007) tested the effects of observational training using social listener reinforcement (SLR) games on the emission of conversational units in non-instructional settings (NIS) across two experiments. In Experiment 1, participants were paired in a dyad and used a peer-yoked contingency game board to play four SLR games ("I Spy," peer tutoring, textually responding, and group instruction) against the experimenter. During each SLR "game" each participant took turns as the listener and the speaker in order to successfully move up on the game board. The results of Experiment 1 showed an increase in conversational units emitted following each phase

in NIS. In the second experiment the experimenters tested the effects of multiple exemplar instruction (MEI) on the acquisition of empathy. Results of this experiment indicated an increase in the number of correct responses to empathy questions such as "How does the person feel?" or "What happened?" (Reilly-Lawson & Walsh, 2007).

Sterkin (2012) tested the effects of SLR on audience control of stereotypy and social operants for children educationally classified with developmental delays. In the first experiment, the effects of social listener reinforcement on the audience control of stereotypy were tested across general education and special education settings. Four participants were chosen after demonstrating low to zero frequency of stereotypy in general education settings and a high frequency of stereotypy in the self-contained setting. Results from the first experiment showed that peers were able to provide social reinforcement by engaging in conversational units, which led to a significant decrease in the emission of stereotypy, and a significant increase in audience control across participants in the general education setting. In the second experiment, the author tested the SLR protocol for four preschool students who emitted low numbers of verbal operants with typically developing classroom peers as well as low levels of correct choral responding during group instruction. In the second experiment prior to the implementation of the SLR protocol, the classroom consisted of two different audiences; one with students who emitted social verbal operants, and one that did not. Following the SLR protocol, participants significantly increased the number of vocal verbal operants with peers and integrated more within the classroom environment.

Baker (2014) tested the effects of SLR and video modeling on the number of social operants emitted in non-instructional settings (NIS) (i.e., snack, free time, walking to and from a set location). Twelve preschool children classified with a disability were selected to participate in this study due to low emission of social operants in NIS. The participants were split up into two

conditions 1) video modeling or 2) SLR. Results showed that participants in both groups increased their social operants with peers in NIS following video modeling and SLR conditions. However, the participants in the SLR condition emitted more social operants with peers in NIS compared to the participants in the modeling condition. In addition, peers assigned to the SLR condition initiated more conversational units and sequelics following the intervention.

Peer-yoked contingencies are effective tactics to induce OL because both peers have to work together in order to receive reinforcement. The peer-yoked contingency acts as an establishing operation; it forces both peers to listen to what the other has to say. By creating a contrived contingency, both peers acquire the listener reinforcement component for emitting social exchanges (Skinner, 1957). Being able to listen to others is a vital aspect of social engagements that can lead to advanced listening repertories (Reilly-Lawson & Walsh 2007). Each peer has to take turns emitting verbal exchanges and conversational units, which reinforce and affect their future listener/speaker behavior. When a person is listening he/she provides reinforcement to the speaker by giving the speaker generalized reinforcement (social attention) or access to the speaker's preferred item (Skinner, 1975). Catania (1998) expanded Skinner's definition of verbal behavior and added "verbal behavior involves both listener behavior shaped by its effect on the speaker's behavior, and speaker behavior shaped by its effect on the listener's behavior" (Catania, 1998, p. 262).

Observational Intervention/Observational Conditioning-by-Denial Intervention (OCDI) to induce conditioned reinforcement by observation.

In the seminal study, Greer et al. (1991) demonstrated a functional relationship between a peer-modeling procedure across two children diagnosed with feeding disorders. In Experiment 1, prior to the intervention an 18-month old male would take small bites of food or liquid and spit them out, and would be fed by gastrostomy device. During the intervention the participant

observed his sister (peer) receive a token after she took a bite of her food while he was denied access to tokens. Following the intervention, the participant consumed solids and liquids orally. In Experiment 2, a 2.5-year-old preschooler educationally classified with a developmental disability participated in this study. He was selected as a participant due to low food consumption throughout the day. Results demonstrated that after the participant observed a peer receive social verbal reinforcement for consuming liquids and solids orally while he did not receive approvals the participant began to increase his consumption of liquids and solids.

Sales (1998) examined the effects of peer presence on conditioning new reinforcers via an observational intervention with three preschool-aged children educationally classified as a preschooler with a disability. Prior to the intervention, the author conducted a functional analysis with neutral stimuli (tokens), and found that tokens did not function as conditioned reinforcers for performance tasks. The participants then entered a peer contingency intervention where a partition separated the participant and a peer. The participant was only able to see the chair and transparent cup next to him/her but was unable to see the tabletop in front on the other side of the partition. The experimenter delivered the antecedent "match" to the participant. After 2s the experimenter delivered a token into the cup in front of the peer, while the target participants did not receive anything (e.g., positive reinforcement) when they emitted a correct response. Results demonstrated that a functional relationship occurred between the peer contingency intervention and tokens becoming a conditioned reinforcer for the target participants for maintenance tasks across target participants.

Greer and Dudek (2008) demonstrated that learning of new conditioned reinforcers emerged as a result of observation with typically developing students and students educationally classified with native disabilities. In their study, participants received a piece of string or a plastic disc when each participant emitted as response for learning and mastered tasks; as a result

the stimuli did not function as a reinforcer for both tasks. The participants then entered a peer competitive intervention where neutral stimuli (plastic discs, and small pieces of string) were delivered to peers while participants were were denied access to neutral stimuli and they observed their peers receive those items. The authors found that neutral stimuli became conditioned reinforcers for mastered and learning tasks for all participants as a result of the intervention (Greer & Singer-Dudek, 2008). Subsequent studies expanded on those findings, conditioning books, praise, and other neutral items (e.g., toothpicks, metal washers, and metal nuts) as conditioned reinforcers using a similar intervention (Dudek & Oblak, 2013; Greer & Dudek, 2008; Greer, Singer-Dudek, Longano, & Zrinzo, 2008).

Singer-Dudek et al. (2011) tested the effects of an observational intervention on establishing children's books as conditioned reinforcers. Three preschool- aged participants, all diagnosed with developmental delays and mild language delays, participated in this experiment. Prior to the observational intervention books were not conditioned as reinforcers for maintenance and learning tasks across all participants. During the intervention participants observed their peer gaining access to books when a correct response was emitted, while the target participants did not receive anything (i.e., positive reinforcement) when they emitted a correct response. Results demonstrated that a functional relationship occurred between the observational intervention and books becoming conditioned reinforcers for the target participants for maintenance and learning tasks across target participants. In addition, books were demonstrated to be conditioned reinforcers for participants in free play settings.

Zrinzo and Greer (2013) investigated the effects of the establishment and maintenance of conditioned reinforcers by observation with preschool-aged children educationally classified with language delays. The authors wanted to investigate if the presence of a known reinforcer (adult/teacher) established conditioned reinforcement by observation, or if the denial component

of the intervention where the participant observed a peer receiving neutral stimuli while the participant was denied access to the neutral stimuli established conditioned reinforcement by observation. Prior to the intervention the authors conducted a functional analysis with neutral stimuli (metal washers), and found that the neutral stimuli did not function as conditioned reinforcers for performance and learning tasks. During the intervention the target participant was able to view the confederate participant receive the metal washers. The metal washers were delivered mechanically to the confederate participant to eliminate the presence of the adult experimenter as a variable. The results showed that metal washers became conditioned reinforcers through observation even without the adult present. Additionally the metal washers were still conditioned as reinforcers six to ten weeks following the intervention.

Singer-Dudek and Oblak (2013) examined the effects of peer presence on conditioning new reinforcers via an observational intervention with preschool-aged children. Prior to the intervention the authors conducted a functional analysis with neutral stimuli (toothpicks), and found that the neutral stimuli did not function as conditioned reinforcers for performance and learning tasks. There were two observational intervention conditions: 1) no peer and 2) with a peer. In the no peer Condition, the participant was seated next to an empty chair, the participant was able to see all of the materials at the empty desk and chair (e.g., the mastered task and clear cup where neutral stimuli were delivered). The peer condition was set up identical to the no-peer condition with one addition- a partition separated the participant and the peer. The participant was only able to see the peer sitting in the chair and transparent cup next to him/her but was unable to see the tabletop in front on the other side of the partition. In both conditions, the experimenter delivered the antecedent "match" to the participant. After 2s the experimenter delivered a toothpick or a piece of string into the cup in front of the empty chair or the peer. The peer condition was identical to the no peer condition except a peer sat on the other side of the

partition. The task and antecedent was the same as in the no peer condition. After the antecedent the experimenter delivered a toothpick or a piece of string into the peer's transparent cup regardless of correct or incorrect response. The results showed that toothpicks became conditioned reinforcers for mastered and learning tasks only when a peer was present, suggesting that peers are a vital source of motivation and/or reinforcement for observational conditioning. Moreover, the authors suggested that the peers, not adults, are the social component of the observational intervention.

Oblak et al. (2015) tested the effects of repeated delivery with a denial component of neutral stimuli (metal nuts) to peers on the establishment of them as conditioned reinforcers. Four preschool-aged children, two typically developing and two educationally classified as a preschooler with a disability, participated in this study. A functional analysis with neutral stimuli (metal nuts) was conducted prior to the intervention. The authors found that metal nuts did not function as conditioned reinforcers for performance and four learning tasks across all participants. During the intervention, the participants were instructed to deliver a metal nut to a peer every 15 s when they heard the timer go off, while they were denied access to the metal nuts themselves. The intervention sessions continued until participants emitted low rates of delivery. The results suggested that following the intervention neutral stimuli (metal nuts) became conditioned reinforcers for performance and learning tasks. In addition, the authors expanded findings demonstrating that reinforcers can be socially conditioned.

Eby and Greer (2017) conducted two experiments on the effects of social reinforcement versus tokens on the spontaneous speech of preschoolers. During the social reinforcement attention condition, the participants were delivered vocal and non-vocal social attention from the experimenter upon the emission of tacts. During the tokens condition, the participants were reinforced for correct tacts with the delivery of tokens into clearly labeled cups without vocal

reinforcement. The results of the first experiment showed that tacts occurred more frequently under social attention reinforcement conditions when compared to token reinforcement conditions for all six participants. The results found tacts were not only reinforced by generalized reinforcers, but more specifically, reinforced by social verbal reinforcement. An increase in the number of tacts emitted for all participants in the first experiment was higher in the social attention condition. In the second experiment, the delivery of tokens was different, to avoid the possibility that the delivery of tokens by an adult in the first experiment functioned as non-vocal reinforcement for the participants. Tokens were delivered through a chute by a second experimenter who was sitting behind a partition out of view. Participants were placed with a peer and remained with that peer throughout the entire study as opposed to the first experiment where all participants were rotated across one another. The results were consistent with the results of the first experiment. Social attention was shown to be the more effective specific type of generalized conditioned reinforcement for the emission of tacts over token reinforcement.

Baowaidan (2016) tested the effects of an observational intervention on the emergence on peer-observing responses, denial responses, and audience appropriate behaviors with preschool-aged children educationally classified with a developmental disability or language delay. Pre-intervention probes showed that all participants inconsistently initiated or reciprocated with their peers across social settings and emitted low peer observing responses. In addition, five out of the nine participants emitted vocal and/or physical requests during the denial condition prior to the intervention. That is, when these participants were denied access to neutral stimuli during the pre-probes five out of the nine participants either vocally and/or physically requested the neutral stimuli, suggesting that conditioned reinforcement by observation was already in their repertories. During the observational intervention the target participant was able to view the peer confederate receive the metal nuts after every response while he/she was denied. The results

suggested that peer observing responses and audience appropriate behaviors increased in social settings and NIS as a function of the observational intervention across eight out of nine participants (Baowaidan, 2016). However, she did not test the reinforcing value of neutral stimuli in before and after the intervention.

Byers (2016) tested if all three types of OL (OL, OP, and conditioned reinforcement by observation) would emerge as a result of repeated probes for children who demonstrated peer awareness. Six preschool- aged children participated in this study. Five out of the six participants were educationally classified with a developmental disability. One out of the six participants was typically developing. The results suggested that all three types of OL emerged as a result of repeated probes across all six participants. Moreover, this was the first study to a) measure peer awareness as a necessary prerequisite to acquiring all three types of OL and b) used repeated probes as an intervention to induce all three types of OL.

In two experiments Katz (2017) tested the effects of social conditions on learning new reinforcers. In Experiment 1, nine 9-12-year old participants who were randomly assigned to be either a peer or participant entered two conditions. Condition 1 assessed whether neutral stimuli would become conditioned reinforcers when both the participant and peer received neutral stimuli simultaneously for emitting correct responses on a mastered math worksheet. In Condition 2, neutral stimuli were delivered to the peer for responses to mastered math facts while the participant was denied access to neutral stimuli. Both conditions were counterbalanced across participants. The results of Experiment 1 showed that conditioned reinforcement for neutral stimuli was established after participants entered Condition 2. In addition, the two peers in the triad also acquired new reinforcers in Condition 2 even though they were not denied access to neutral stimuli. In Experiment 2, nine participants were randomly assigned to triads that consisted of two peer participants and one (recipient) participant. The two peer participants

observed the recipient receive neutral stimuli while all three participants were completing mastered worksheets. The results showed that neutral stimuli became conditioned reinforcers in eight out of nine participants, including the observing peers.

Singer-Dudek et al. (2013) tested the effects of an observational intervention on the emergence of two types of observational learning: OL and OP. Three seven-year-old children educationally classified with autism participated in this study. Prior to the intervention the authors conducted a functional analysis with neutral stimuli (cotton swabs), and found that the neutral stimuli did not function as conditioned reinforcers for performance and three learning tasks across all participants. During the observational intervention both the participant and peer performed a mastered task. Throughout the mastered task the experimenter delivered a cotton swab (neutral stimuli) every six s into the peer's transparent cup. The main difference with this intervention was that there was no partition to separate the peer and participant. Both the participant and peer could see and observe the other child perform the mastered task. When the participant vocally requested and or physically attempted to gain access to the neutral stimuli the experimenters ignored the participant's requests. The intervention ended when either the participant vocally requested and/or made physical attempts to gain the neutral stimuli. The results suggested that neutral stimuli (cotton swabs) became conditioned reinforcers through the observational intervention for performance and learning tasks. All three participants acquired observational learning and observational performance. Moreover, this was the first study demonstrating the establishment of two types of observational learning: OL and OP, using a peer-competitive intervention.

Rationale and Purpose of the Study

The results of this program of research (Byers, 2016; Eby & Greer, 2017; Gold, 2013; Greer et al., 1991; Greer & Dudek, 2008; Greer et al., 2008; Katz, 2017; Oblak et al., 2015; Sales, 1998; Singer-Dudek et al., 2011; Singer-Dudek, et al., 2013; Singer-Dudek & Oblak, 2013; Zrino & Greer, 2013) show that individuals can acquire new reinforcers through observation under denial conditions. These studies found that changes in behavior were due to the acquisition of conditioned reinforcement for a neutral stimulus that previously did not function as a reinforcer for learning and performance/mastered tasks as a function of an observational intervention that included a denial condition did not function to condition new reinforcers, rather, establishing operations were created.

An *establishing operation* (EO) is an "environmental event, operation, or stimulus condition that affects an organism by momentarily altering (a) the reinforcing effectiveness of other events and (b) the frequency of occurrence of that part of the organism's repertoire relevant to those events as consequences" (Michael, 1993, p. 192). However, an EO momentarily alters one's behavior whereas, when a verbal behavior developmental cusp is established that behavior is maintained over time.

Zrino and Greer (2013) found that follow-up probes conducted six-ten weeks later demonstrated that previously neutral stimuli were still conditioned as reinforcers. These results suggest that the acquisition of new conditioned reinforcers was not due to an establishing operation because effects were maintained over time. To date, there are no other studies outside of this program of research that have been found that examine the acquisition of conditioned reinforcement for a neutral stimulus that previously did not function as a reinforcer in humans. Thus, it is imperative to both expand and replicate these results.

Gold (2013) found that OL, OP, and Naming emerged from a yoked contingency game board and Byers (2016) found that OL, OP, and conditioned reinforcement by observation emerged from a single intervention using a peer-yoked contingency. Baowaidan (2016) used an observational intervention to increase audience-appropriate behaviors but did not test for conditioned reinforcement by observation as a cusp. Similarly, Katz (2017) used an observational intervention to increase participants' verbal behavior and conditioning new reinforcers in dyads and triads but did not test for conditioned reinforcement by observation as a cusp.

Singer-Dudek et al. (2013) found that OL and OP were established as a result of an observational intervention. Participants observed peers receive neutral stimuli (cotton swabs) that did not reinforce participants' behavior while they were denied access during the intervention. However, Singer-Dudek et al. (2013) did not test for conditioned reinforcement by observation. While other studies have demonstrated that an observational intervention/observational conditioning-by-denial intervention has successfully established OL, OP, and conditioned reinforcement by observation no studies have tested if an observational intervention/observational conditioning-by-denial intervention can induce all three types of OL in one experiment (Byers, 2016; Eby & Greer, 2017; Gold, 2013; Greer & Dudek, 2008; Greer et al., 2008; Katz, 2017; Oblak et al., 2015; Sales, 1998; Singer-Dudek et al., 2011; Singer-Dudek, et al., 2013; Singer-Dudek & Oblak, 2013; Zrino & Greer, 2013). Therefore, in Experiment 1 I sought to test if an observational conditioning-by-denial intervention can establish all three types of OL.

CHAPTER II

EXPERIMENT I

Method

Overview

Experiment 1 was implemented across five stages with six elementary-aged children, educationally classified with autism spectrum disorder and multiple disabilities, using a series of probes. In Stage 1, I conducted a series of pre-intervention reinforcer assessments that 1) tested the reinforcement effects of known stimuli (edibles) and non-preferred stimuli (binder clips) on a mastered task and 2) tested the reinforcement effects of non-preferred stimuli (binder clips) on three learning tasks. For the mastered task I measured the rate (number per minute) of correct and incorrect responses under a) known reinforcers (edibles) and b) non-preferred stimuli conditions to ensure that non-preferred neutral stimuli for any participant were not conditioned as reinforcers. The learning tasks consisted of three academic programs that varied depending on each child's skill set. During the learning tasks, a transparent cup was placed in front of the participant. The researcher continued instruction as usual except that, when the participant emitted a correct response, a binder clip (neutral stimulus) was dropped into his/her clear cup. I measured the number of correct and incorrect responses under the non-preferred stimuli condition to ensure that neutral stimuli were not conditioned reinforcers for learning tasks (i.e., learning would not occur). In the second stage, I tested for the presence of conditioned reinforcement by observation, observational learning of performance (OP), and observational acquisition of new operants (OL) in a series of probes across participants. In the third stage, I implemented an observational conditioning-by-denial intervention (OCDI) involving a peer who received the non-preferred stimuli while the observing participant was denied access to reinforcement. Once the participant manded and/or physically grabbed for the neutral stimuli,

one or more times across two consecutive sessions participants entered Stage 4. Stage 4 was identical to Stage 1. I wanted to assess if binder clips (neutral stimuli) became a conditioned reinforcer for both mastered and learning tasks following the intervention. Following the conclusion of Stage 4 participants entered Stage 5, in which post-probes for OLR, OP, and OL were conducted.

Participants

Six students, two females and four males, five educationally classified with autism spectrum disorder (ASD) and one student who was educationally classified with multiple disabilities (MD) were selected to participate in this experiment. The classroom they were selected from was located in a suburban area outside of a large metropolitan city. At the onset of this study, all six participants attended a self-contained special education classroom in a public elementary school that employed and operated the Comprehensive Application of Behavior Analysis to Schooling (CABAS®) educational model (www.cabasschools.org) for at least one year prior to the onset of the study. Thus, all participants had a long instructional history of receiving learn units. The *learn unit* is an interlocking operant between the teacher and the student (Albers & Greer, 1991). It usually involves 2-3 operants for the teacher and a target operant for the student. The learn unit includes a clear and precise antecedent that is delivered to the student while he/she is attending to the instructor, the response emitted by the student, and a consequence that the student receives. The consequence can be either reinforcement for a correct response, or a correction for an incorrect response. A correction involves a re-presentation of the antecedent, followed by the student emitting the correct response that is not reinforced. When teachers present direct learn units to each student it allows each student to be reinforced or receive a correction based on his/her response to the antecedent. Research has shown that when

students receive direct learn units they tend to learn at a faster rate compared to traditional pre-scientific methods of teaching (Albers & Greer, 1991; Greer, 2002; Ingram & Greer, 1994).

In addition, all participants had a history of receiving positive reinforcement in the form of social praise, playful physical contact, tokens, and preferred edibles for correct responses and following classroom directions. Moreover, they also had a history with unconsequated probe trials, where positive reinforcement was delivered for non-target behaviors (i.e., following classroom directions) but not for emitting correct and incorrect responses.

All participants received individual one-to-one and small group instruction (two to three students) across all subject areas throughout the school day. The participants also attended some other instruction that was held either outside or inside the classroom (gym, art, music, speech therapy, occupational therapy, counseling, physical therapy) nine to fifteen times a week.

At the onset of this experiment, Participants A-F functioned at the listener/speaker, levels of verbal behavior and all but Participant F had some early reader/writer cusps established, according to the *Verbal Behavior Development Assessment* (VBDA©) (Greer & Keohane, 2005; Greer & Ross, 2008). It should be noted that Participant D could not speak and used an iPad® with Proloquo2Go© to communicate. All long-and short-term instructional objectives were measured using the participants' individualized education plan (IEP) goals as well as the CABAS® *International Curriculum and Inventory of Repertories for Children from Preschool Through Kindergarten* (C-PIRK©) (Greer, 2013). The C-PIRK© is a criterion- referenced assessment that also functions as a curriculum assesses over 300 skills across academics, communication, community of reinforcers, and self-management domains.

Each participant could maintain eye contact up to five s, and emitted verbal operants in the form of mands and tacts with adults and preferred peers. All participants used a five-word

minimum when they emitted a mand (i.e., "I want the cookie please"). All participants had at least 50 tacts in their repertoire.

The participants were selected for this study because they did not demonstrate conditioned reinforcement for the items identified as neutral stimuli, observational performance, and observational acquisition of new operants. Each participant's level of verbal behavior and academic repertoires at the onset of the experiment are reported in Tables 1 and 2.

Table 1
Description of Participants by Age, Grade, Gender, Educational Classification, and IQ scores

Participant	Age	Grade	Gender	Educational Classification	IQ	Verbal Score	Non-Verbal Score
A	7.4	1st	M	ASD	86	83	91
B	7.8	2nd	F	ASD	82	67	100
C	8.2	2nd	M	ASD	59	47	75
D	7.10	2nd	F	ASD	N/A	N/A	57
E	5.5	K	M	ASD	94	106	83
F	7.4	2nd	M	MD	56	58	57

Note: M=Male, F=Female. ASD= Autism Spectrum Disorder, MD= Multiple Disabilities.

Table 2
Description of the Participants' Social Verbal Behavior Developmental Cusps and Capabilities Present at the Onset of the Experiment

Participant	A	B	C	D	E	F
CR for Adult Faces	Y	Y	Y	Y	Y	Y
CR for Adult Voices	Y	Y	Y	Y	Y	Y
Generalized Imitation	Y	Y	Y	Y	Y	Y
Listener Literacy	Y	Y	Y	Y	Y	Y
Independent Mands	Y	Y	Y	Y	Y	Y
Independent Tacts under Social Reinforcement	Y	Y	Y	Y	Y	Y
Unidirectional Naming	Y	Y	Y	Y	Y	Y
Bidirectional Naming	Y	N	N	Y	Y	N
CR by Observation (OLR)	N	N	N	N	N	N
Observational Performance (OP)	Y	N	N	N	N	N
Observational Acquisition (OL)	N	N	N	N	N	N

Note. CR= Conditioned Reinforcement, Y=Yes, N=No.

Setting

All pre-and post-intervention reinforcer assessments for mastered and learning tasks and experimental probes were conducted in the participants' self-contained classroom, or outside in the hall while the other students received 1:1 instruction. Experimental probe sessions were conducted at a 91.44 by 122 cm circular table in the participant's classroom. Other students in the classroom received 1:1 or small group instruction during these probe sessions.

The observational conditioning-by-denial intervention was conducted in the participants' self-contained classroom, or in the hallway while the other students received 1:1 instruction. The intervention was conducted at two 45.72 by 60.96 cm desks in the participant's classroom or in the hallway. The two desks were separated by a 1.75 x 1.8 m partition. Other students in the classroom received 1:1 or small group instruction during intervention sessions.

Materials

The materials utilized in pre- and post-experimental probes were black pens, books, Post it® notes, paper clips, binder clips, pre-made data sheets, materials for performance probes, and tokens (see Table 3). The materials used during the peer-competitive contingency were binder clips, a partition, pre-made data sheets, clear cups, and pencils (see Table 3).

Table 3
Description of materials used in Experiment 1

-Black Pens	-Partition
-Data sheets	-Laminated 8'x 11" sheet of paper with
-Skittles	shapes on it
-Starbursts	-Index cards
-Gummy Bears	-Animal figurines
-Red, blue and yellow paper clips	-Post it notes
-Small Binder Clips	-Tokens
-Clear plastic cups	-Token Boards
-Yellow, green and red construction paper	
-Timer	

Design

In this experiment, I utilized a variation of a multi-element design across all participants. I first included an alternating treatment design as a conditioned reinforcer assessment to test the reinforcing effects of neutral stimuli (binder clips) prior to and following the observational conditioning-by denial-intervention for mastered and learning tasks. Following that, I used a multiple probe design across all participants to measure the effects of the intervention on the three types of OL. The sequence of the experiment is displayed in Figures 1 and 2.

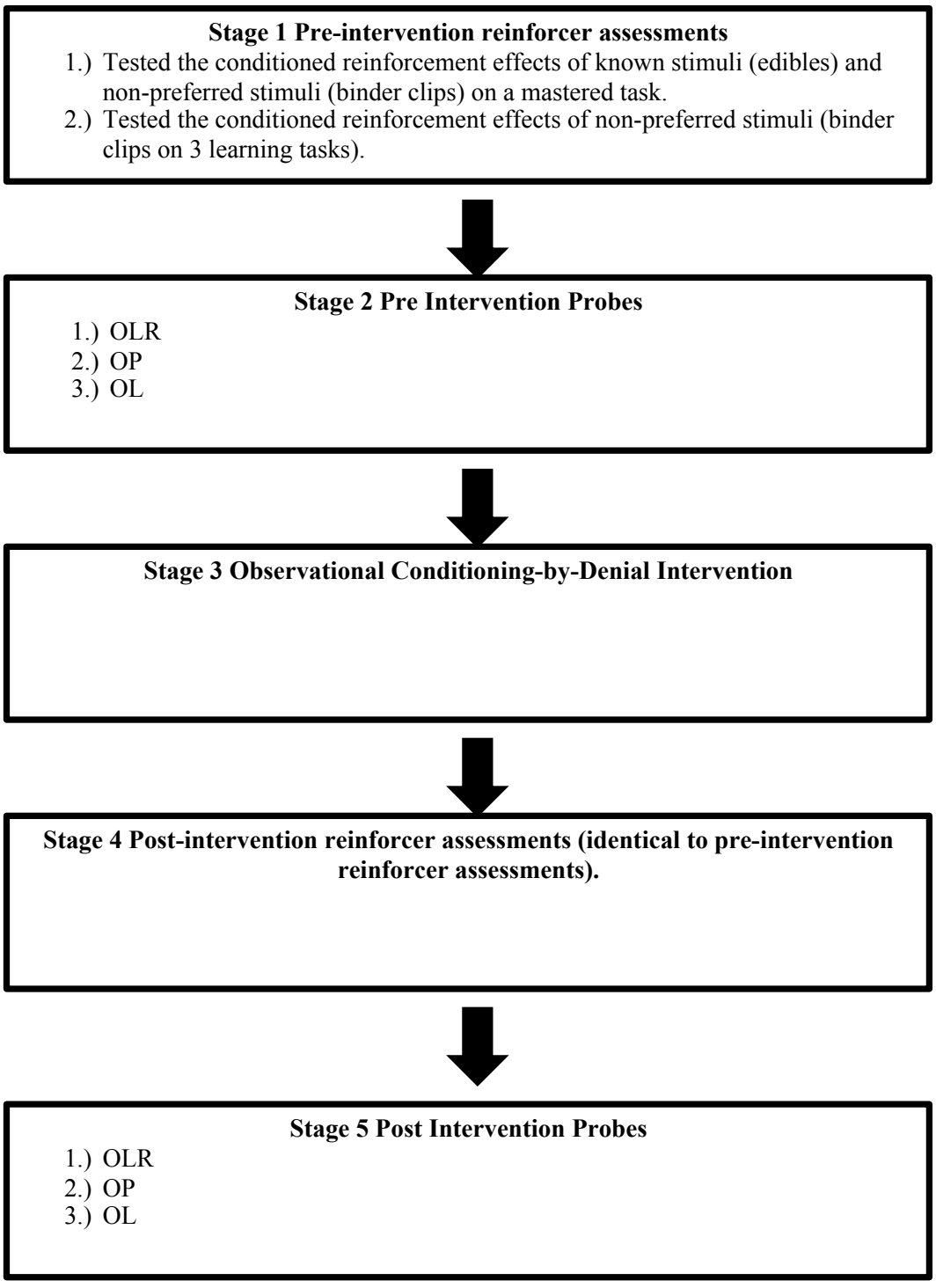


Figure 1. Overall sequence of design

Participants													
A	Pre	*OCDI*	Post										
B			Pre	*OCDI*	Post								
C					Pre	*OCDI*	Post						
D							Pre	*OCDI*	Post				
E									Pre	*OCDI*	Post		
F											Pre	*OCDI*	Post

Figure 2. The experimental sequence across participants. In this figure, *Pre* indicates pre-intervention probes, *Post* indicates post-intervention probes, and *OCDI* indicates the observational conditioning-by-denial intervention.

Dependent Variables

The dependent variables in this study were probes for OLR, OP, and OL.

Conditioned Reinforcement by Observation (OLR) probes. A peer and participant sat at a table. The researcher read both children a story. While reading the story the researcher delivered neutral stimuli (i.e., Post it® notes) to the peer. The experimenter did not provide any verbal or physical prompts to the participant to attend to his or her peer. During the probe there were 10 opportunities for the participant to mand for the Post it® notes. If the participant made a vocal request/mand for the Post it® notes an M was recorded. If the participant physically went to reach for Post it® notes a P was recorded. If the participant visually tracked the neutral stimuli (Post it®) a V was recorded. If the participant didn't track, emit a vocal response, or emit a physical attempt within five s a minus (-) was recorded. The participants' responses were graphically displayed out of the ten opportunities recorded (see Figure 7).

Observational Performance (OP) Probes. A peer and participant sat at a table. Both peers were given plastic toy animals that appeared similar in structure but were different (i.e., the target participant received a toy Ape and the confederate peer got a toy Lion). The experimenter did not provide any verbal or physical prompts to ensure that the participant was attending to the peer. When the peer started to manipulate the plastic toy, the experimenter reinforced the peer's behavior with approvals, i.e., "Cool, I like what you're doing" and attended to the peer. The

participant had five s to duplicate the peer's behavior. If the target participant duplicated the peer's behavior a plus (+) was recorded on the data sheet. If the target peer did not duplicate the peer's behavior a minus (-) was recorded. The probe consisted of ten trials. Criterion for observational performance was 80% (8 correct responses) or higher. The participants' responses were graphically displayed out of the ten opportunities recorded (see Figure 8). See Table 4 for a description of stimuli.

Table 4
Description of OP Stimuli

Participants	Stimuli
A, B, C, D, E and F	Lion
	Ape
	Dragon Fly
	Dog
	Bear
	Zebra
	Frog
	Caterpillar
	Butterfly
	Horse
	Camel
	Cat
	Dinosaur

Observational Acquisition of New Operants (OL) Probes. The experimenter sat down at a table with a peer and participant. Before the probe began the experimenter showed both the peer and participant five stimuli to ensure that both children did not know any of the stimuli. Once the experimenter knew that both children did not know the stimuli, a set of five stimuli with four exemplars (total of 20 trials) was used during the probe session. The peer and participant sat next to each other during the probe. The experimenter sat across from them, telling both children that they were going to play a game, and that the children needed to pay close attention. The experimenter did not prompt the participant and peer if they did not attend to

the stimuli during probe trials. The experimenter then presented a novel stimulus (e.g., a cartoon character) to the peer. While the experimenter presented the picture to the peer, the participant (target) was required to observe. If the peer emitted a correct response a plus (+) was recorded, and he/she was delivered social praise (e.g., "good job"). If he/she emitted an incorrect response a minus (-) was recorded, and a correction was performed. A correction consisted of the experimenter telling the peer the correct response (e.g., "Dino") and the peer then echoed the correct response. Following that the experimenter presented "Dino" to the peer until he/she emitted the correct response independently. The experimenter presented 3-4 operants to the peer. During this time the experimenter attended to the peer but delivered social praise (i.e., nice job) to both children. Following the 3-4 tact/picture presentations to the peer, the experimenter then presented the same 3-4 tacts/pictures to the participant. If the participant emitted a correct response a plus (+) was recorded, if he/she emitted an incorrect response a minus (-) was recorded. In addition, he/she was not reinforced/corrected if he/she emitted a correct or incorrect response. However, both participants were reinforced for following classroom rules, (e.g., sitting nicely, having hands on the table). The probe consisted of twenty trials; criterion for each session was 80% (16 correct responses) or higher. The participants' responses were graphically displayed out of the twenty opportunities recorded (see Figure 9). See Table 5 for a description of stimuli.

Table 5.
Description of OL Stimuli

Participants	Stimuli	Novel Stimuli
A	Speedy	Arnold
	Taz	Jug Head
	Boris	Bianca
	Top Cat	Chucky
	Pop Eye	Natasha
B	Gem	Under Dog
	Casper	Little John
	Woody	Bernard
	Pink Panther	Chucky
	Doug	Tweety Bird
C	Pebbles	
	Flower	
	Brain	
	Angelica	
	Bruno	
D	Olive Oil	Elmer Fud
	Shaggy	Archie
	Tommy Pickles	Drusilla
	Suzie	Sweet Pea
	Pokey	Rosie
E	Elroy	
	Fred	
	Judy	
	Bugs Bunny	
	Marvin	
F	Jane	Speedy
	Bam Bam	Taz
	Barney	Boris
	K-9	Top Cat
	Road Runner	Pop Eye

Independent Variable

The independent variable in this experiment was the observational conditioning- by-denial intervention. I first conducted a series of pre-intervention reinforcer assessments that

tested the reinforcement effects of 1) known reinforcing stimuli (edibles) and non-preferred stimuli on a mastered task and 2) tested the reinforcement effects of non-preferred stimuli on three learning tasks for each participant. These pre-intervention reinforcer assessments established that neutral stimuli (binder clips) did not function as conditioned reinforcers for mastered tasks and learning tasks for participants.

Testing the reinforcement effects of known reinforcing stimuli (edibles) and non-preferred stimuli on mastered tasks. The task consisted of the number of colored paper clips each participant could sort in 60 s. The experimenter placed 60 paperclips (20 red, 20 yellow and 20 blue) on the table in front of each participant. The experimenter spread out all of the paper clips across a small area of the table. Once the paperclips were spread out the experimenter placed three colored cups (one red, one yellow, and one blue cup) on the table behind the array of paper clips (see Figure 3). The experimenter then explained to each participant that they were going to start a race. The participant had to go as fast as he/she could but to be careful that each colored paperclip went into the correct colored cup. Each time the participant correctly put a colored paperclip into the correct cup (i.e., the red paper clip went into the red cup), the participant received a piece of preferred edible (Phase A) (i.e., piece of a skittle), or a binder clip (Phase B). The experimenter delivered the edibles and neutral stimuli (small binder clips) into a transparent plastic cup. During both phases the experimenter did not deliver any type of vocal verbal praise. Each participant's sequence of phases was counterbalanced across all six participants. Rate was calculated for the number of correct responses and number of incorrect responses emitted in one min. Correct responses constituted placing the paperclip in the correct colored cup. Incorrect responses were defined as a participant placing a paperclip in a different colored cup or no response. When steady state responding occurred the participant entered the

next phase. The participants' rates of correct and incorrect responses were graphically displayed for visual analysis (see Figure 10). See Table 6 for a description of the sequence of phases.

Table 6
Description of the Sequence of Phases

Participant	Phase Sequence
A	ABABABAB
B	BABABABA
C	ABABABAB
D	BABABABA
E	ABABABAB
F	BABABABA

Note. A=Edibles and B=Neutral Stimuli/Binder Clips

Figure 3: Materials used in the Reinforcer Assessment for a mastered task in Experiment 1

Testing the reinforcement effects of non-preferred stimuli on three learning tasks.

Three novel learning tasks that were not in the participant's repertoire were presented to each participant. Learning tasks varied based on each participant's academic ability. See Table 6 for a list of individualized learning tasks. Each learning task consisted of 20 trials. Praise was not delivered during these tasks. Every time a participant emitted a correct response a plus (+) was recorded and a binder clip (neutral stimulus) was delivered into an opaque cup (see Figure 4). When the participant emitted an incorrect response a minus (-) was recorded and the participant was delivered a correction by the researcher, as outlined above. If the participant met criterion (90% or higher accuracy across two consecutive sessions) the task was discontinued. The task was also discontinued if the participant's correct responses began to decrease or steady state responding occurred. The probe consisted of 20 trials; criterion for each task was 90% (18 correct responses) or higher. The participant's correct responses were graphically displayed out of the 20 opportunities recorded (see Figure 11). See Table 7 for a description of each task across participants.

Figure 4: The neutral stimuli used in the reinforcer assessment: learning task in Experiment 1.

Table 7
Description of each Participant's Learning Tasks

Participant	Task 1	Task 2	Task 3
A	Vocal Addition (6-fact family)	Telling Time _*:10*-_:50 (vocally producing the correct time and showing on a clock the correct time)	Counting Change (15-25 cents)
B	Vocal Addition (3 fact family)	Prepositions (in front and behind)	Vocally spelling pre-primer Dolch Words
C	Vocal Addition (2-fact family)	Sorting pictures based on their beginning blend sound (Qu, Wh, Tw, and K)	Identifying number of syllables in 3-4 words
D	Rhyming CVC/CVCE words	Spelling first grade Dolch words via iPad	More/Less
E	Following 2 Step Directions	Orally Spelling Dolch words	Identifying Phonemes
F	Following 2 Step Directions	Matching CV blends (at, in, op, en)	Identifying lower case letters (a, d, t, m)

Observational Conditioning-by-Denial Intervention (OCDI)

Two children (one peer and one participant) sat at a table. They were separated by a partition whereby the participant was only able to see the peer's transparent cup where neutral stimuli (binder clips) were delivered and not the other materials on the tabletop (see Figure 5). Both children were able to see and hear each other and the experimenter during the intervention. The experimenter delivered a mastered task (matching ten different shapes on a sheet of paper) to both children simultaneously (see Figure 6). The participant did not receive any sort of reinforcement but the peer received neutral stimuli (binder clip) during all 10 trials. The

experimenter recorded the number of physical attempts (e.g., trying to grab the binder clips), verbal requests/mands (e.g., “I want the binder clips” or “can I have some too?”), and visual tracking of the stimuli (e.g., the participant would watch the binder clips being dropped into the cup but wouldn’t physically and or vocally ask for them). Criterion for ending the intervention was the participant physically attempting and/or vocally attempting to gain access to the binder clips at least one time during the session across two consecutive sessions. Following criterion for stopping the observational conditioning-by-denial intervention the participant entered post-intervention probes that were identical to the pre-intervention probes, and were conducted to assess the effects of the intervention on the establishment of conditioned reinforcement by observation, OP, and OL (see Figure 12).

Figure 5: The Observational Conditioning-by-denial intervention set up used in Experiments 1 and 2.

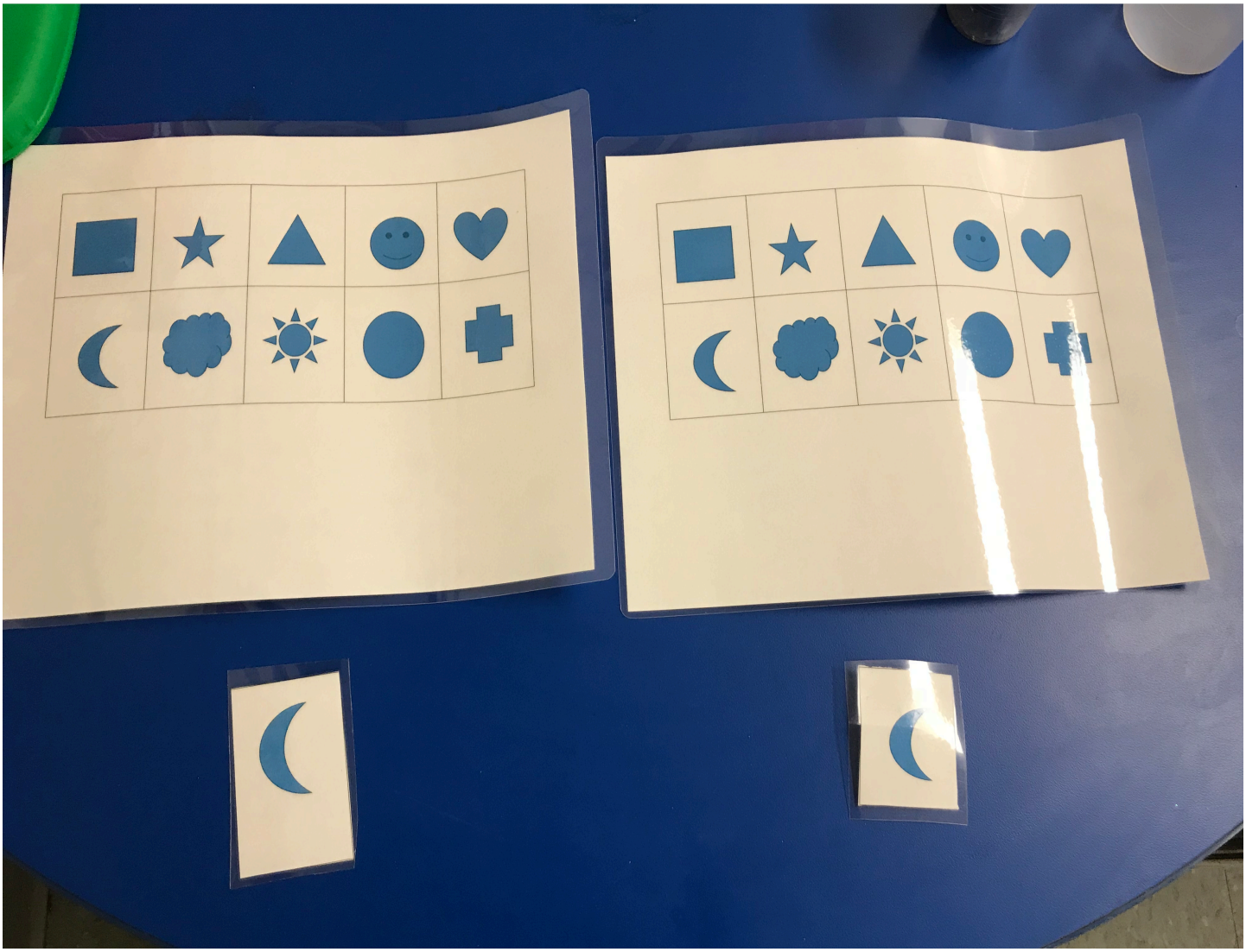


Figure 6: The master task used in the Observational Conditioning-by-Denial Intervention for both experiments.

Interobserver Agreement

Interobserver Agreement (IOA) was conducted during pre-and post-probe sessions to ensure the accuracy of the procedural fidelity of the data. A second observer and myself simultaneously but independently recorded data on number of correct and incorrect responses. The Teacher Performance Rate and Accuracy (TPRA) measure was used to test fidelity of treatment and accuracy of recording of participant responses (Ingham & Greer, 1994). The TPRA is a direct teacher observation that is used to measure the presence and/or absence of learn units (Ross, Greer, & Dudek, 2005). TPRA's help improve the teacher's delivery of learn units, and increase the number of correct responses emitted by students, while decreasing the number of incorrect responses of students (Greer, 2002). Assistant researchers were calibrated using the TPRA until they achieved 100% accuracy on presenting learn units for tact instruction. Following the conclusion of the probe sessions, data were then compared across observers for the reinforcement assessment (mastered and learning tasks), OLR, OP, OL probes and the intervention sessions. The second observer was either a supervisor, or a teaching assistant (TA) in the classroom who was trained in the analysis of verbal behavior. IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements items and multiplying by 100 (Johnston & Pennypacker, 1993). IOA for all participants is summarized in Table 8.

Table 8

Interobserver Agreement Collected for All Participants for Pre-and Post-Intervention probes

Participant	A	B	C	D	E	F
Pre and-post intervention Reinforcer Assessment Mastered Task						
Percentage of Sessions	38%	25%	21%	17%	19%	23%
Mean Agreement	100%	100%	100%	100%	100%	100%
Pre- and- post intervention Reinforcer Assessment Learning Tasks						
Percentage of Sessions	50%	36%	45%	33%		
Mean Agreement	100%	100%	100%	100%	100%	100%
OLR Probes						
Percentage of Sessions	100%	100%	100%	100%	100%	100%
Mean Agreement	100%	100%	100%	100%	100%	100%
OL Probes						
Percentage of Sessions	100%	100%	100%	100%	100%	100%
Mean Agreement	100%	100%	100%	100%	100%	100%
OP Probes						
Percentage of Sessions	100%	100%	100%	100%	100%	100%
Mean Agreement	100%	100%	100%	100%	100%	100%
Intervention						
Percentage of Sessions	100%	100%	100%	100%	100%	100%
Mean Agreement	100%	100%	100%	100%	96%	96%

Results

Figures 7 and 8 show the rate of correct and incorrect responses to mastered and leaning tasks by each participant during pre- and post-intervention reinforcer assessments. Overall, the results from this experiment showed increases in the rate of responding for the mastered task and increased responses for the learning tasks after the intervention when binder clips were delivered, suggesting that binder clips became a conditioned reinforcer as a result of the intervention across all six participants.

Figure 9 shows the number of vocal requests/mands or physical attempts made by each participant to gain access to the neutral stimuli when denied access to the neutral stimuli during

the pre- and post-intervention probes. Following the intervention, the responses to the denial of neutral stimuli delivered to peers increased in 4 out of 6 participants, who did not respond during pre-intervention probes.

Figures 10 and 11 show the number of correct responses emitted by each participant during pre- and post-intervention probes. In Figure 10 there were a total of 10 observed opportunities in each OP probe session. In Figure 11 there were a total of 20 observed opportunities in each probe session OL.

Figure 12 shows the participants' responses to the intervention and the number of intervention sessions for each participant. Intervention sessions ranged from 2 to 11 sessions across all participants. Following the intervention 4 out of 6 participants established conditioned reinforcement by observation, OP and OL.

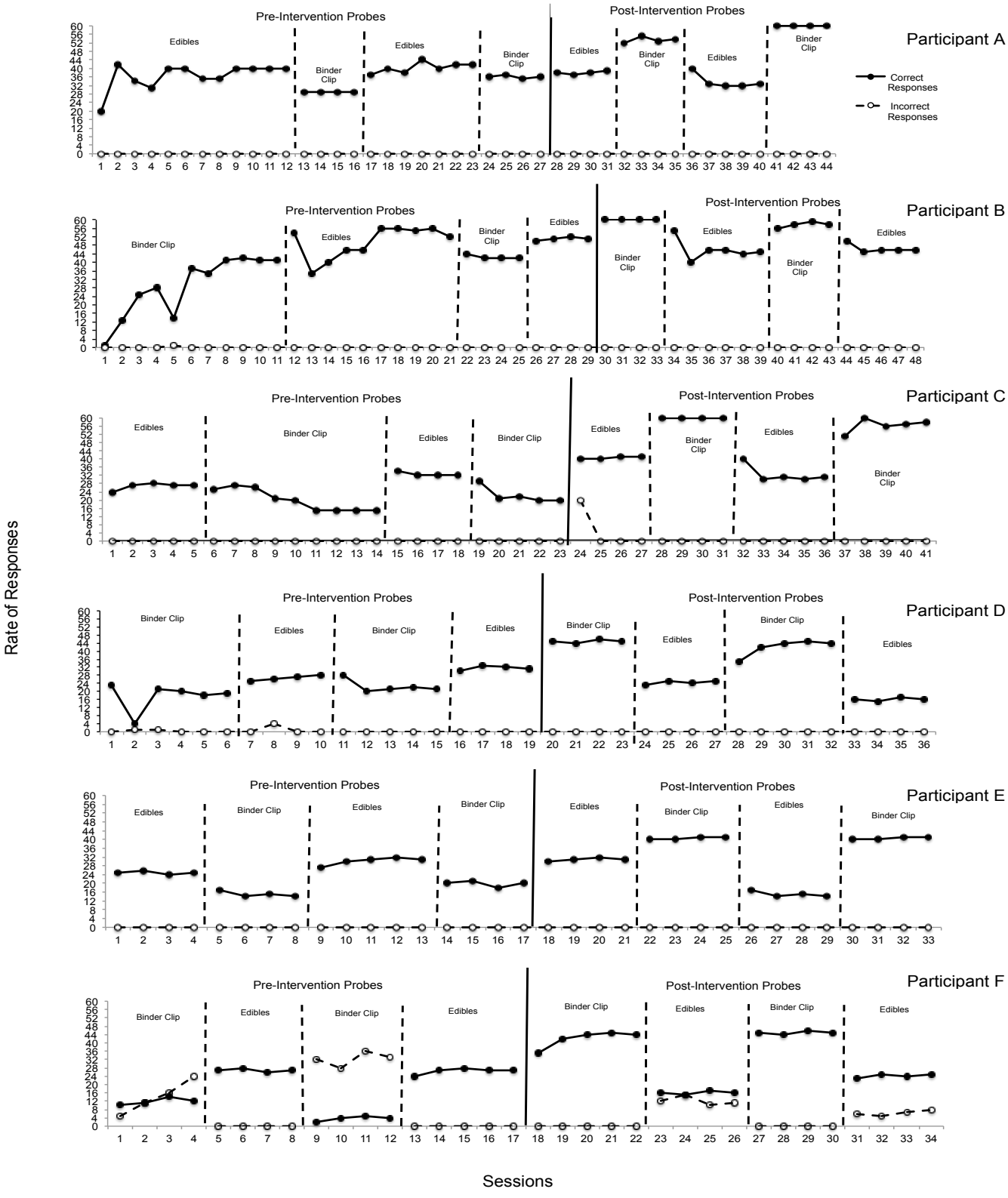


Figure 7: The rate of correct and incorrect responses emitted by the participants during a pre- and-post reinforcer assessment for a mastered task. The solid line denotes the observational conditioning-by-denial intervention.

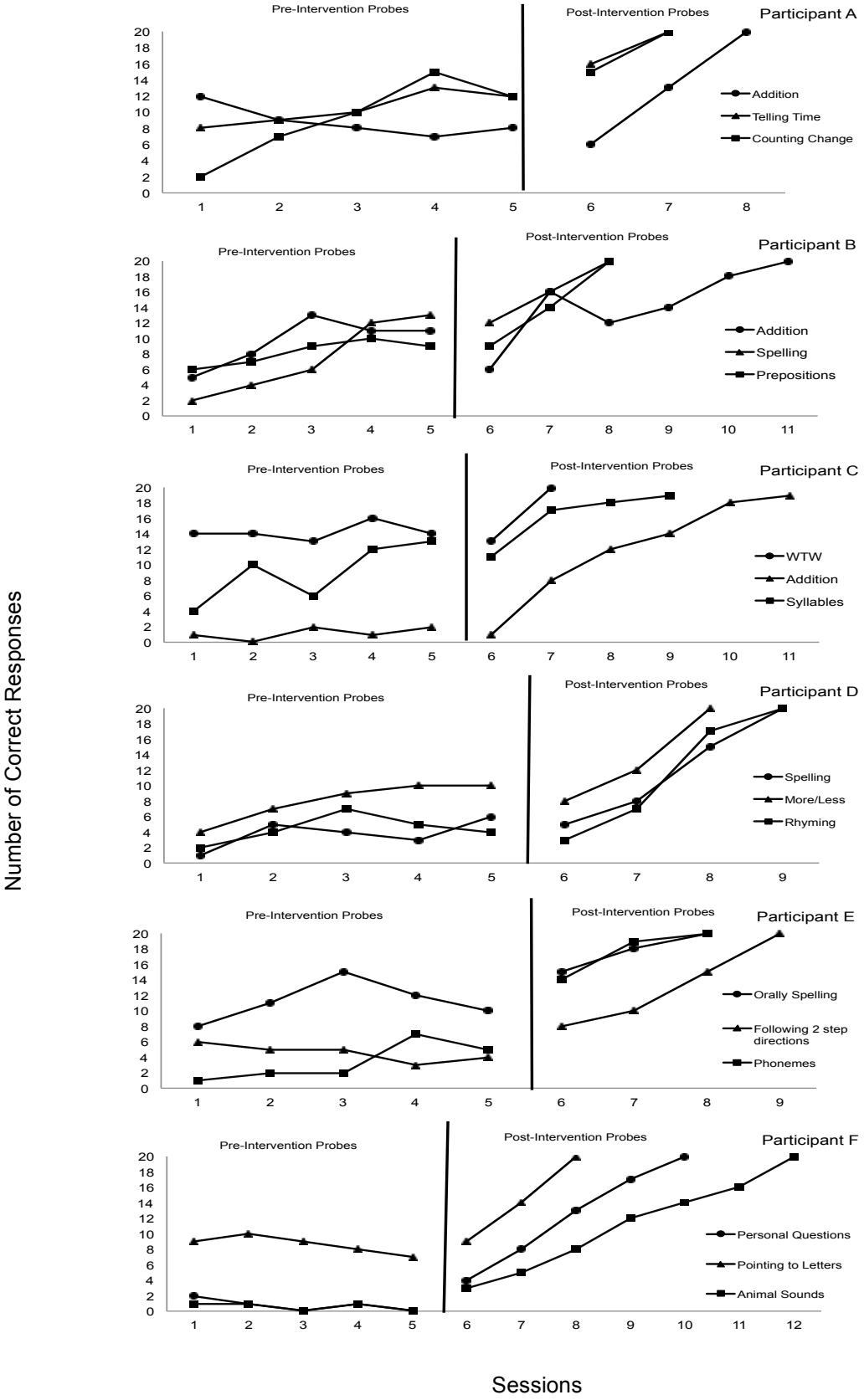


Figure 8: The number of correct responses emitted by the participants during a pre- and-post reinforcer assessment for a 3 learning tasks. The solid line denotes the observational conditioning-by-denial intervention.

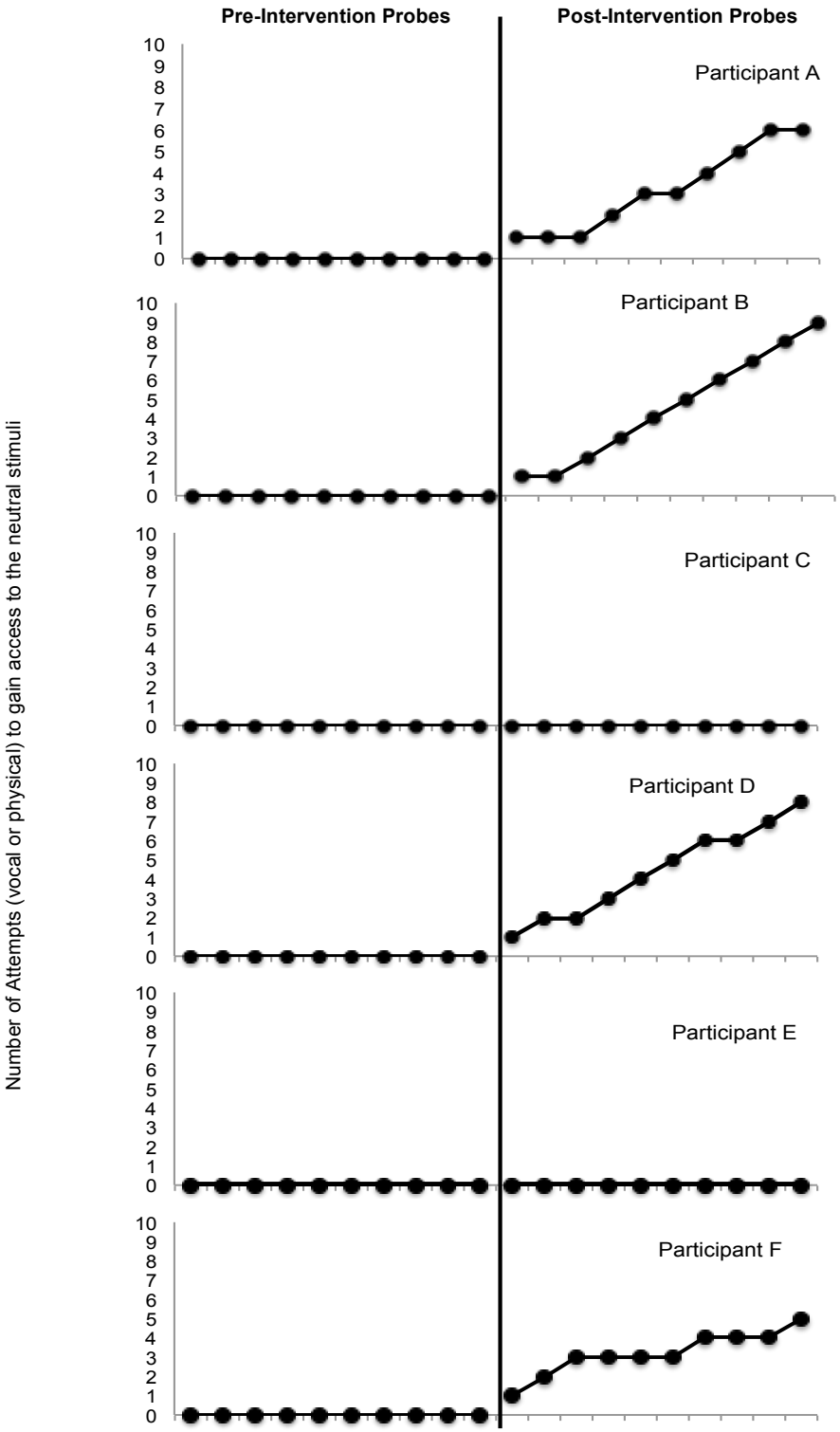


Figure 9: Participants' responses to the denial of non-preferred stimuli being delivered to peer during pre- and post-intervention probes. The responses are presented out of ten opportunities. The solid line denotes the observational conditioning-by-denial intervention.

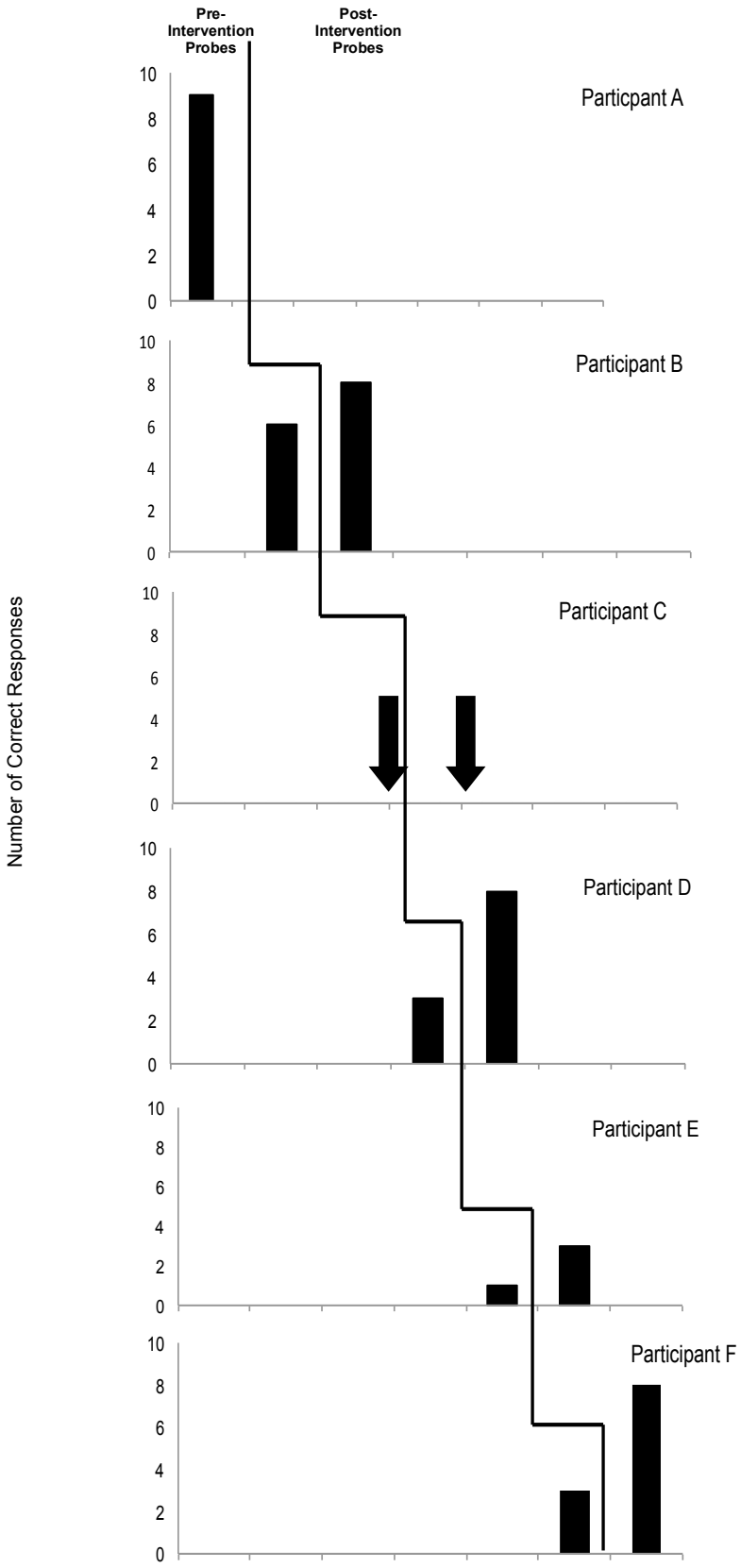


Figure 10: The number of correct observational performance responses emitted by the participants during pre- and post-intervention probes. The responses are presented out of ten opportunities. The solid line denotes the observational conditioning-by-denial intervention.

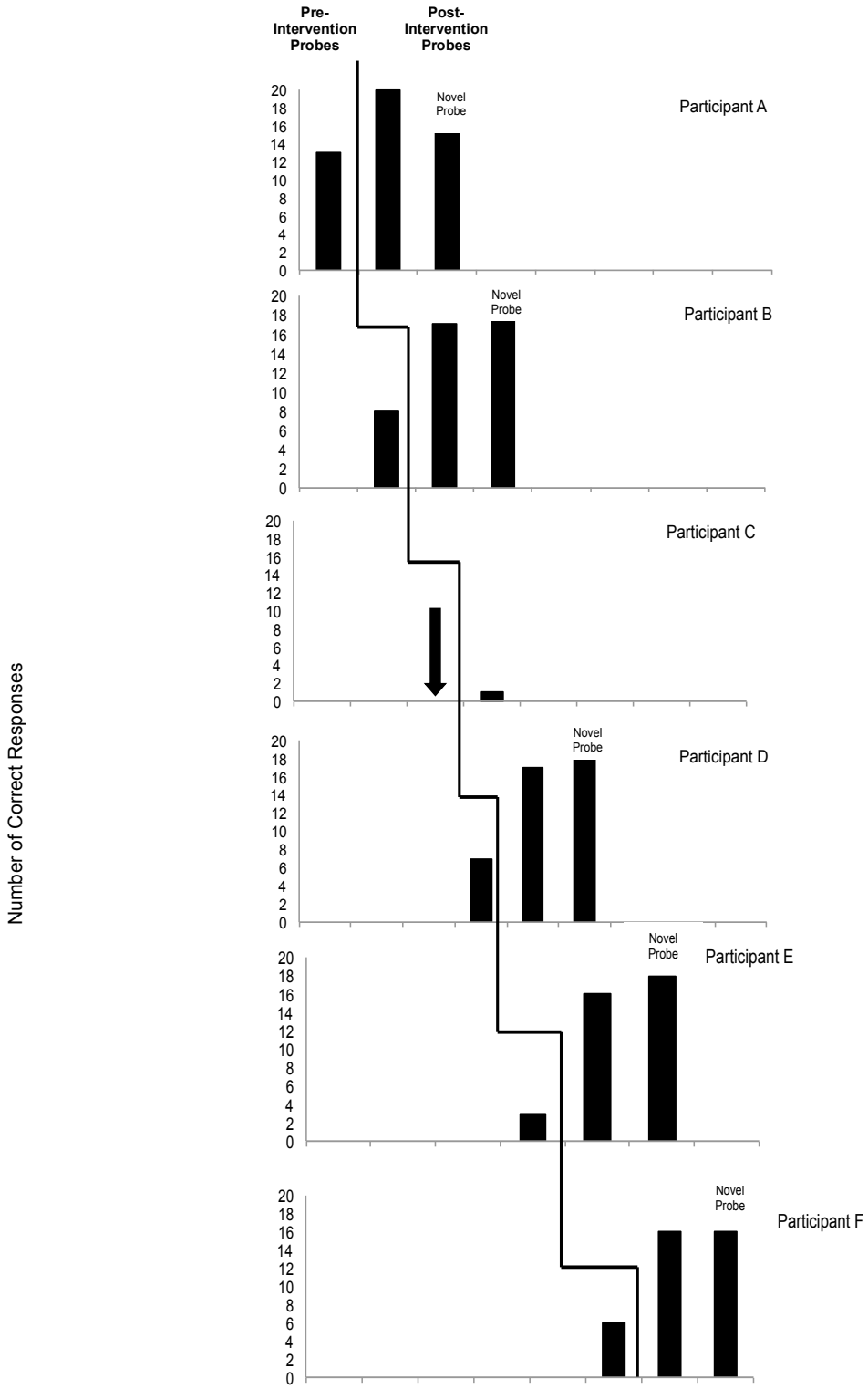


Figure 11: The number of correct acquisition of new operant responses emitted by the participants during pre- and post-intervention probes. The responses are presented out of twenty opportunities. The solid line denotes the observational conditioning-by-denial intervention.

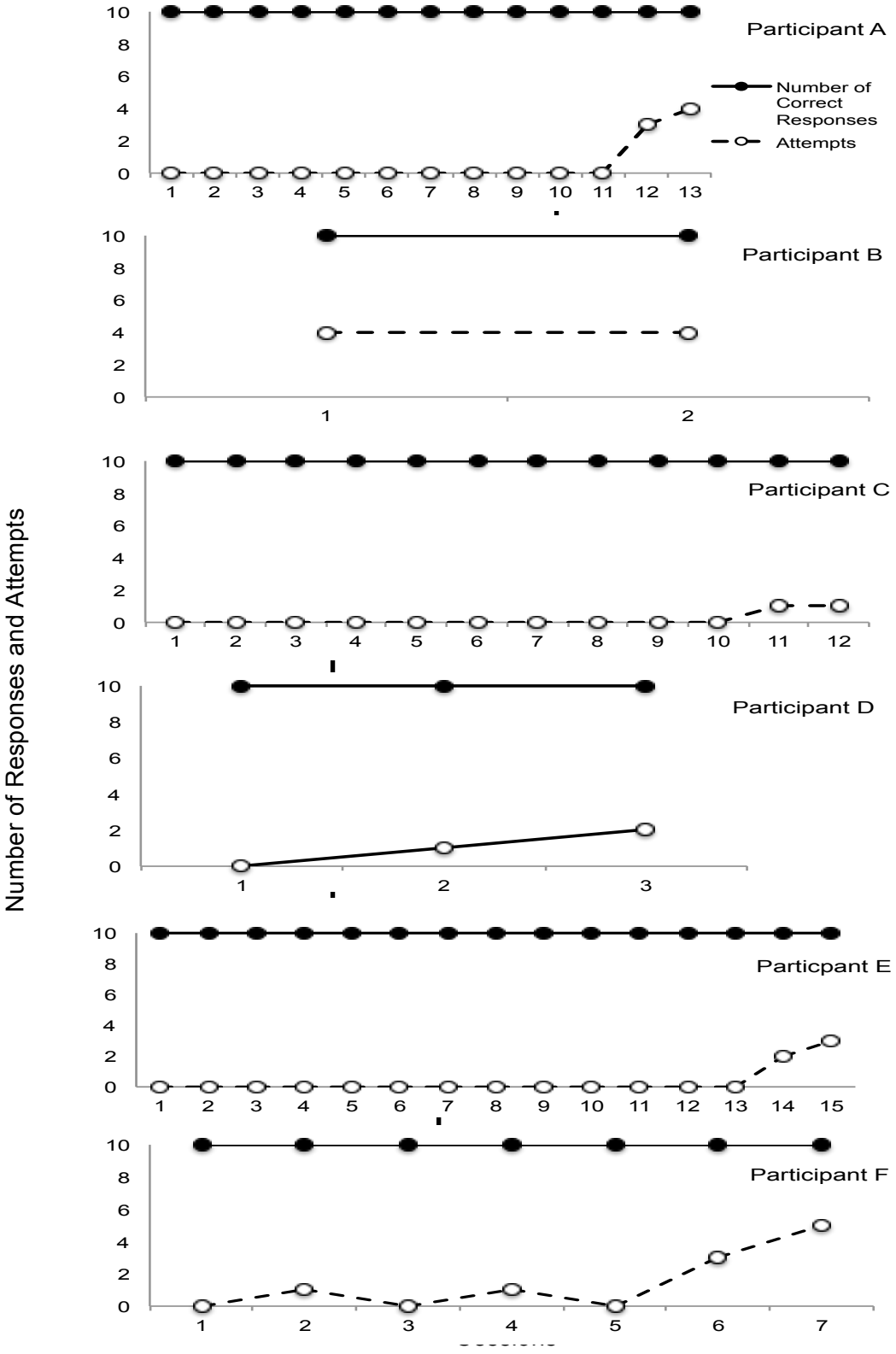


Figure 12: The number of correct responses and number of attempts during the observational conditioning-by-denial intervention.

Discussion of Experiment 1 and Rationale for Experiment 2

OLR, OP, and OL Probes: Experiment 1 is the first study that demonstrated that an observational conditioning-by-denial intervention is an effective intervention to establish all three types of OL when an individual has peer attention in his/her repertoire. The results of Experiment 1 are consistent with Baowaidan's (2016) and Byers' (2016) results, suggesting that peer attention is a necessary prerequisite in order to enter an intervention (e.g., peer yoked contingency, observational conditioning by denial intervention, or repeated probes) to induce conditioned reinforcement by observation, OP, and OL.

Following the intervention all six participants' rate of completing a mastered task increased when neutral stimuli were delivered compared to when a known conditioned reinforcer was delivered. In addition, following the intervention all six participants' acquisition of novel material across three learning tasks increased.

In addition, the results of Experiment 1 are consistent with the results of Byers' (2016) and Singer-Dudek et al.'s (2013) studies. The results of Experiment 1 show similar findings to studies that employed different independent variables (e.g., yoked contingency and repeated probes) to establish one or more types of OL (Baowaidan, 2016; Byers, 2016; Dudek & Oblak, 2013; Eby & Greer, 2017; Gold, 2013; Greer & Dudek, 2008; Greer et al., 2008; Oblak et al., 2015; Singer-Dudek et al., 2011; Singer-Dudek, et al., 2013; Zrino & Greer, 2013).

Other studies have used this intervention to establish one or two types of OL but this is the first study to test whether a single intervention can establish all three types of OL (Byers, 2016; Eby & Greer, 2017; Gold, 2013; Greer & Dudek, 2008; Greer et al., 2008; Katz, 2017; Oblak et al., 2015; Sales, 1998; Singer-Dudek et al., 2011; Singer-Dudek, et al., 2013; Singer-Dudek & Oblak, 2013; Zrino & Greer, 2013).

Limitations

Peer-Awareness. Anecdotal classroom observations demonstrated that Participants A, B, D, and F in Experiment 1, who acquired conditioned reinforcement by observation, OP, and OL, had peer attention in their repertoire prior to the intervention, whereas Participants C and E did not demonstrate peer attention. Due to all of the participants' instructional history with the experimenter, it is possible that since the experimenter had been paired with the delivery of the neutral stimuli, the experimenter became the S^D for responding, no matter what the consequence.

During the reinforcer assessment for mastered and learning tasks, the neutral items (paper clips and binder clips) may have become conditioned reinforcers as a result of the experimenter delivering the neutral stimuli across all probes. An additional limitation of Experiment 1 is that the reinforcer assessment of a mastered and three learning tasks, as well as the OLR probes, did not measure if conditioned reinforcement by observation is a verbal behavior developmental cusp.

Rationale for Experiment 2

While there have been several successful studies where an observational conditioning-by-denial intervention conditioned neutral stimuli as reinforcers for mastered and learning tasks, there have been no tests on the establishment of the cusp to acquire new reinforcers via observation. One way to test whether conditioned reinforcement by observation is a verbal behavior developmental cusp is to measure whether participants would willingly trade in their tokens to play with neutral stimuli across individual and peer settings prior to and after the intervention. Therefore, the purpose Experiment 2 is to test whether conditioned reinforcement by observation is a verbal behavior developmental cusp. Rosales-Ruiz and Baer (1997) define a cusp as a change in a person's contact with their environment that allows a multitude of new interactions. If conditioned reinforcement by observation is a verbal behavior developmental

cusp the participants in Experiment 2 will be able acquire new reinforcers via observation. Following the intervention, if participants willingly choose to exchange their tokens for stimuli not directly conditioned when they did not before the intervention, conditioned reinforcement by observation can be confirmed as a verbal behavior developmental cusp. In Experiment 2 I will ensure that all participants demonstrate peer attention prior to the onset of the study and test if conditioned reinforcement by observation is a verbal behavior development cusp.

CHAPTER III

EXPERIMENT 2

In Experiment 2, I measured if conditioned reinforcement by observation is a verbal behavior development cusp by using two reinforcer assessments 1) individual reinforcer assessment and 2) peer reinforcer assessment as well as all three types of OL probes prior to and after entering an observational conditioning-by-denial intervention.

Method

Participants

Participants for Experiment 2 were selected because they met two criteria: a) they had peer-awareness in their repertoire and b) they did not demonstrate all three types of observational learning (conditioned reinforcement by observation, OP, and OL). Each participant's level of verbal behavior and academic repertoires at the onset of the experiment are reported in Tables 9 and 10.

Table 9
Description of Participants by Age, Grade, Gender, Educational Classification, and IQ Scores

Participant	Age	Grade	Gender	Educational Classification	IQ	Verbal Score	Non-Verbal Score
G	7.2	1st	M	ASD	88	72	105
H	5.10	1st	M	ASD	108	105	110
I	6.11	2nd	M	SLI	66	54	N/A
J	7.0	2nd	M	ASD	90	67	97

Note: M=Male, F=Female. ASD= Autism Spectrum Disorder, SLI= Speech and Language Impairments.

Table 10
Description of the Participants' Social Verbal Behavior Developmental Cusps and Capabilities Present at the Onset of the Experiment

Participant	G	H	I	J
CR for Adult Faces	Y	Y	Y	Y
CR for Adult Voices	Y	Y	Y	Y
Generalized Imitation	Y	Y	Y	Y
Listener Literacy	Y	Y	Y	Y
Independent Mands	Y	Y	Y	Y
Independent Tacts under Social Reinforcement	Y	Y	Y	Y
Unidirectional Naming	Y	Y	Y	Y
Bidirectional Naming	Y	N	N	N
CR by Observation (OLR)	N	N	N	N
Observational Performance (OP)	N	N	N	N
Observational Acquisition (OL)	N	N	N	N

Note. CR= Conditioned Reinforcement, Y=Yes, N=No.

Setting and Materials

The setting was the same as in Experiment 1. The probes and observational conditioning-by-denial intervention were conducted in the participants' self-contained classroom, or in the hallway while the other students received 1:1 instruction. The materials used in Experiment 2 were the same materials used in Experiment 1, except for the addition of neutral stimuli used in the reinforcer assessments (e.g., s-hooks, metal washers, and shelf support spoon) (see Table 11 for description of stimuli).

Table 11
Neutral Stimuli used in the Individual and Peer Reinforcer Assessments



Design

I utilized a delayed multiple probe design across all participants. Once a participant finished the first phase of the reinforcer assessment and moved into the next phase a new participant entered the first phase. Please see Figure 13 for a sequence of Experiment 2.

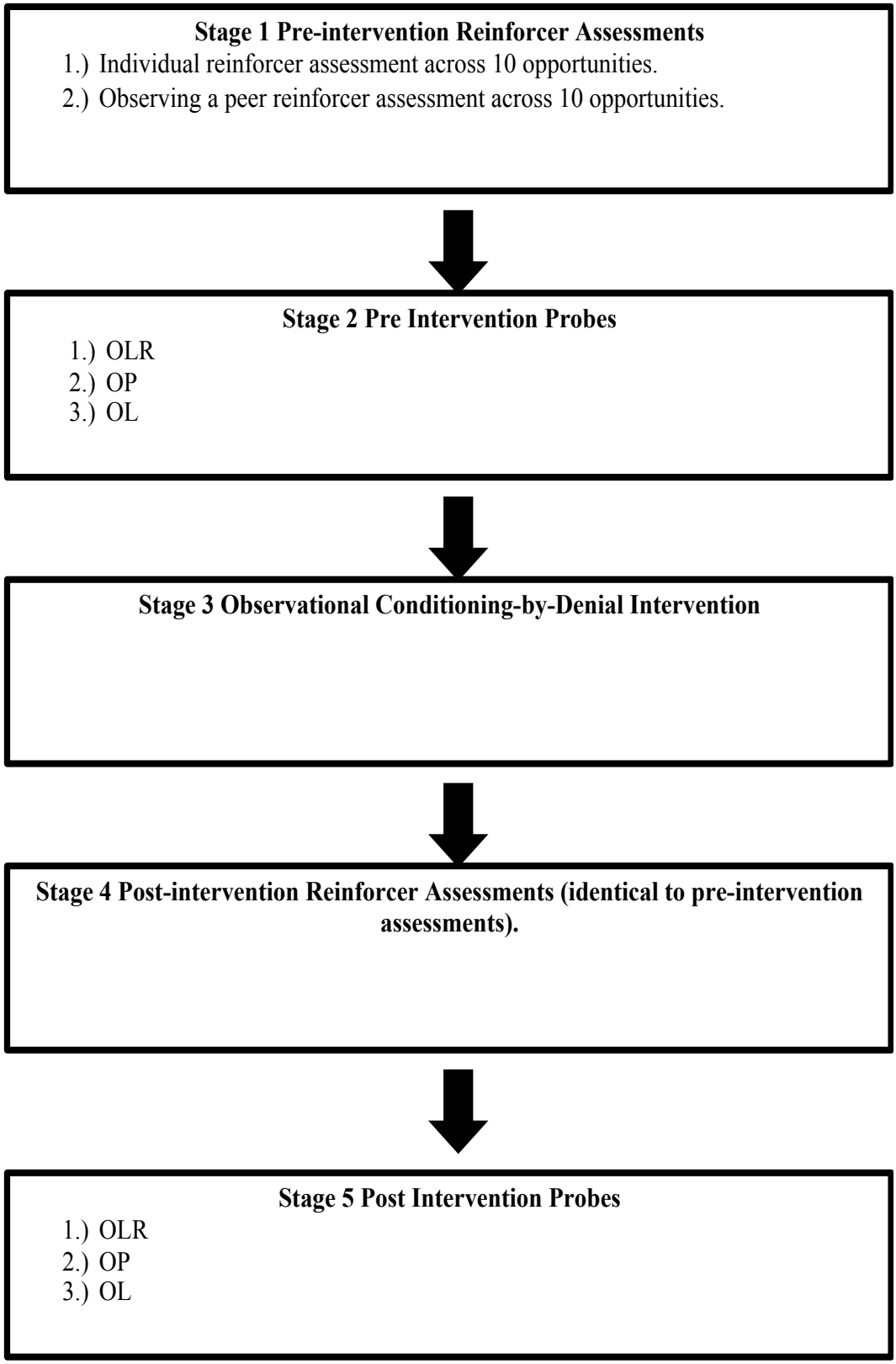


Figure 13. Overall sequence of design.

Dependent Variables

The dependent variables in Experiment 2 were the same as the dependent variables used in Experiment 1. I conducted probes for OLR, OP, and OL (see Table 12 for a description of stimuli used in the OL probes). The probes for OLR, OP, and OL were the same as Experiment 1 (see Figures 15-17). In addition two reinforcer assessments (individual and peer) were added to account for the limitation in Experiment 1, assessing whether conditioned reinforcement by observation is a verbal behavior developmental cusp.

Table 12
Description of OL Stimuli

Participants	Stimuli	Novel Stimuli
A	Captain Planet	Olive Oil
	Jane	Shaggy
	Patty	Tommy Pickles
	Ren	Suzie
	Stimpy	Pokey
B	Elmer Fud	Pebbles
	Archie	Flower
	Drusilla	Brain
	Sweet Pea	Angelica
	Rosie	Bruno
C	Mushu	Gem
	Gumby	Casper
	Ella	Woody
	Pongo	Pink Panther
	Pokey	Doug
D	Angelica	Jane
	Pebbles	Bam-Bam
	Riff Raff	K-9
	Rosie	Road Runner
	Little Jon	Marvin

Individual Reinforcer Assessment. Prior to the peer reinforcer assessment and following the conclusion of the intervention, whenever the participant earned his/her tokens to trade in for his back-up reinforcers, an array of neutral stimuli and known reinforcers were

presented to each participant. The stimuli used in Experiment 2 were different than the stimuli the participants and other students could trade in their tokens for in the classroom's "token store". The stimuli were displayed in transparent boxes on a table. Each box had a lid attached to it (see Figure 14). For three of the five boxes neutral stimuli were placed in each box. The neutral stimuli were: S-hooks, washers, and spoon shelf supports (see Table 11). Prior to the onset of the experiment the participants were never exposed to the neutral stimuli. In the other two boxes were the participants' preferred stimuli (e.g., waffle blocks, MagnaTiles®, and/or plastic toy animals). The experimenter told each participant that he/she got to open one of the five boxes and pick something to play with. The experimenter then recorded which stimuli the participant chose to play with. The participants' responses were graphically displayed out of the ten opportunities recorded (see Figure 18).

Peer Reinforcer Assessment. Following the individual reinforcer assessment, prior to the onset of the intervention, and following the conclusion of the intervention, whenever the participant earned his/her tokens to trade in for his/her back-up reinforcer a peer was seated at a table playing with one of the three neutral stimuli in the transparent boxes (see Figure 14). The target participant observed the peer playing with the neutral stimuli for 30 s prior to being told the participant could pick an item from the five boxes. The same stimuli that were used in the individual reinforcer assessment were also used in the peer reinforcer assessment (three neutral and two preferred). The experimenter then recorded which stimuli the participant chose to play with while he/she observed the peer play with neutral stimuli. The participants' responses were graphically displayed out of the ten opportunities recorded (see Figure 19).

Figure 14: The materials used in the individual and peer reinforcer assessments.

Independent Variable

The independent variable in Experiment 2 was the same as the independent variable in Experiment 1, an observational conditioning-by-denial intervention (see Figure 20).

Interobserver Agreement. IOA for all participants is summarized in Table 13.

Table 13
Interobserver Agreement Collected for All Participants for Pre-and Post-Intervention probes

Participant	A	B	C	D
Pre and-post intervention Individual Reinforcer Assessment				
Percentage of Sessions	80%	70%	75%	65%
Mean Agreement	100%	100%	100%	100%
Pre- and- post intervention Peer Reinforcer Assessment				
Percentage of Sessions	90%	80%	85%	75%
Mean Agreement	100%	100%	100%	100%
OLR Probes				
Percentage of Sessions	100%	100%	100%	100%
Mean Agreement	100%	100%	100%	100%
OP Probes				
Percentage of Sessions	100%	100%	100%	100%
Mean Agreement	100%	100%	100%	100%
OL Probes				
Percentage of Sessions	100%	100%	100%	100%
Mean Agreement	100%	100%	100%	100%
Intervention				
Percentage of Sessions	60%	71%	66%	50%
Mean Agreement	100%	100%	100%	100%

Results

Figure 15 shows the number of vocal requests/mands or physical attempts made by each participant to gain access to the neutral stimuli when denied access to the neutral stimuli during the pre- and post-intervention probes. Following the intervention, the responses to the denial of neutral stimuli delivered to peers increased in all participants, who did not respond during pre-intervention probes.

Figures 16 and 17 show the number of correct responses emitted by each participant during pre- and post-intervention probes. In Figure 16 there were a total of 10 observed opportunities in each OP probe session. In Figure 17 there were a total of 20 observed opportunities in each probe session OL. Following the peer-competitive contingency intervention OP and OL were established across all participants.

Figures 18 and 19 show the number of preferred and neutral stimuli selected in the individual and peer reinforcer assessments. Overall, the results from this experiment showed increases in neutral stimuli selected during their trade-in time after participants earned all of their tokens in both the individual and peer reinforcer assessments following the intervention, suggesting that neutral stimuli became conditioned reinforcers as a result of the intervention across all participants.

Figure 20 shows the participants' responses to the observational conditioning-by- denial intervention and the number of intervention sessions for each participant. Intervention sessions ranged from 2 to 10 sessions across all participants. Following the intervention all participants established conditioned reinforcement by observation, OP and OL.

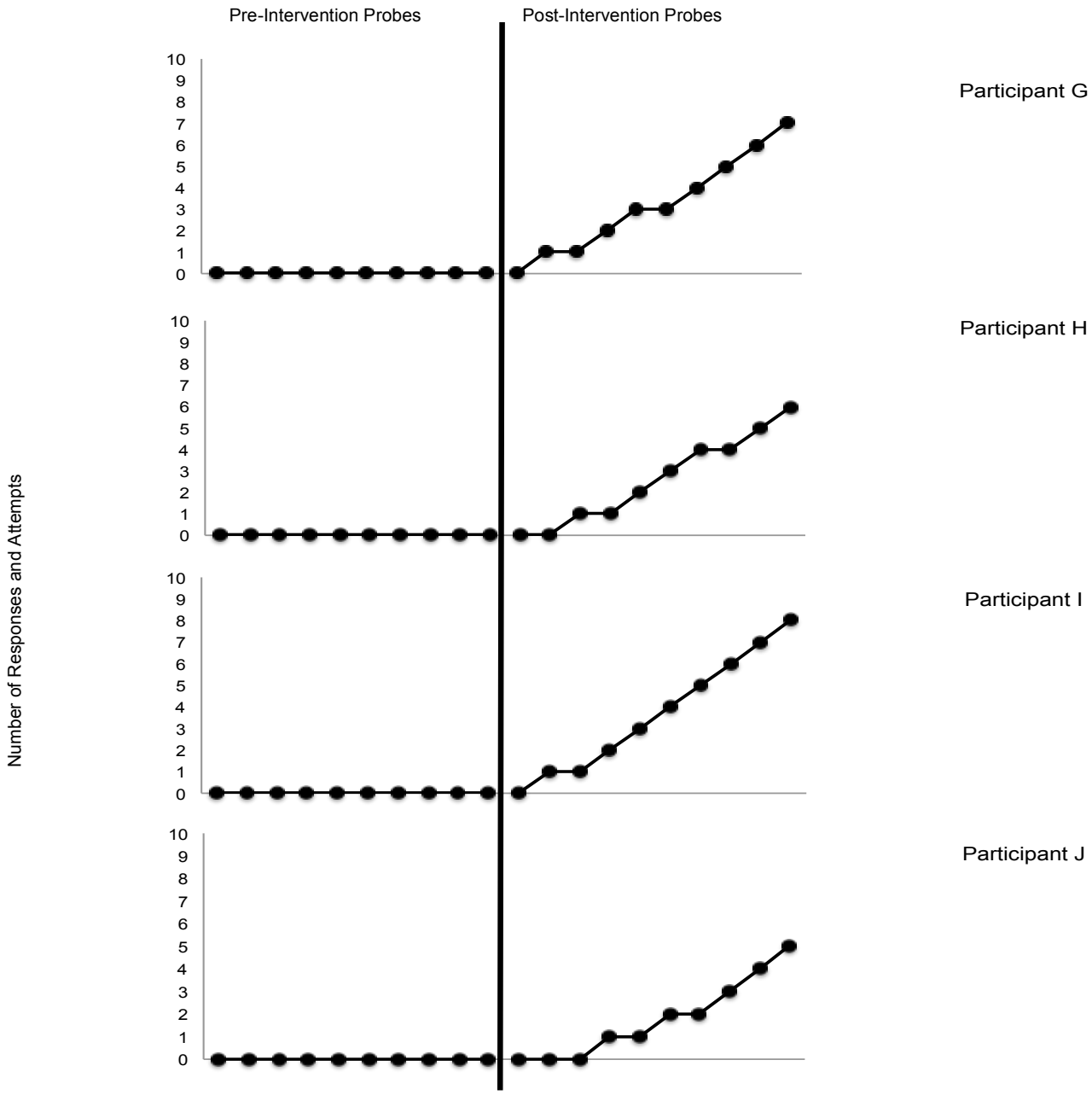


Figure 15: Participants responses to the denial of non-preferred stimuli being delivered to peers during pre- and post-intervention probes. The responses are presented out of ten opportunities. The solid line denotes the observational conditioning-by-denial intervention.

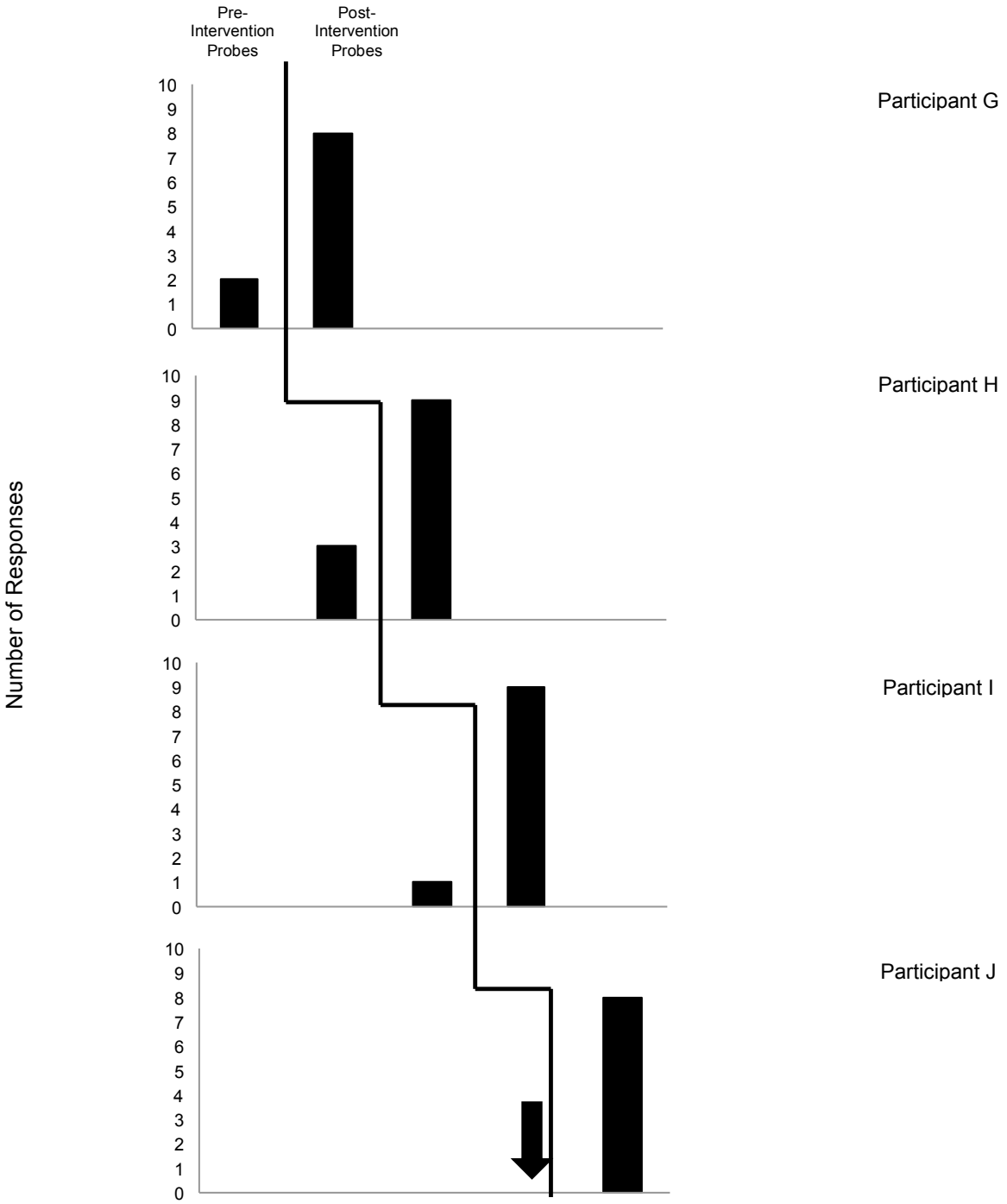


Figure 16: The number of correct observational performance responses emitted by the participants during pre- and post-intervention probes. The responses are presented out of ten opportunities. The solid line denotes the observational conditioning-by-denial intervention.

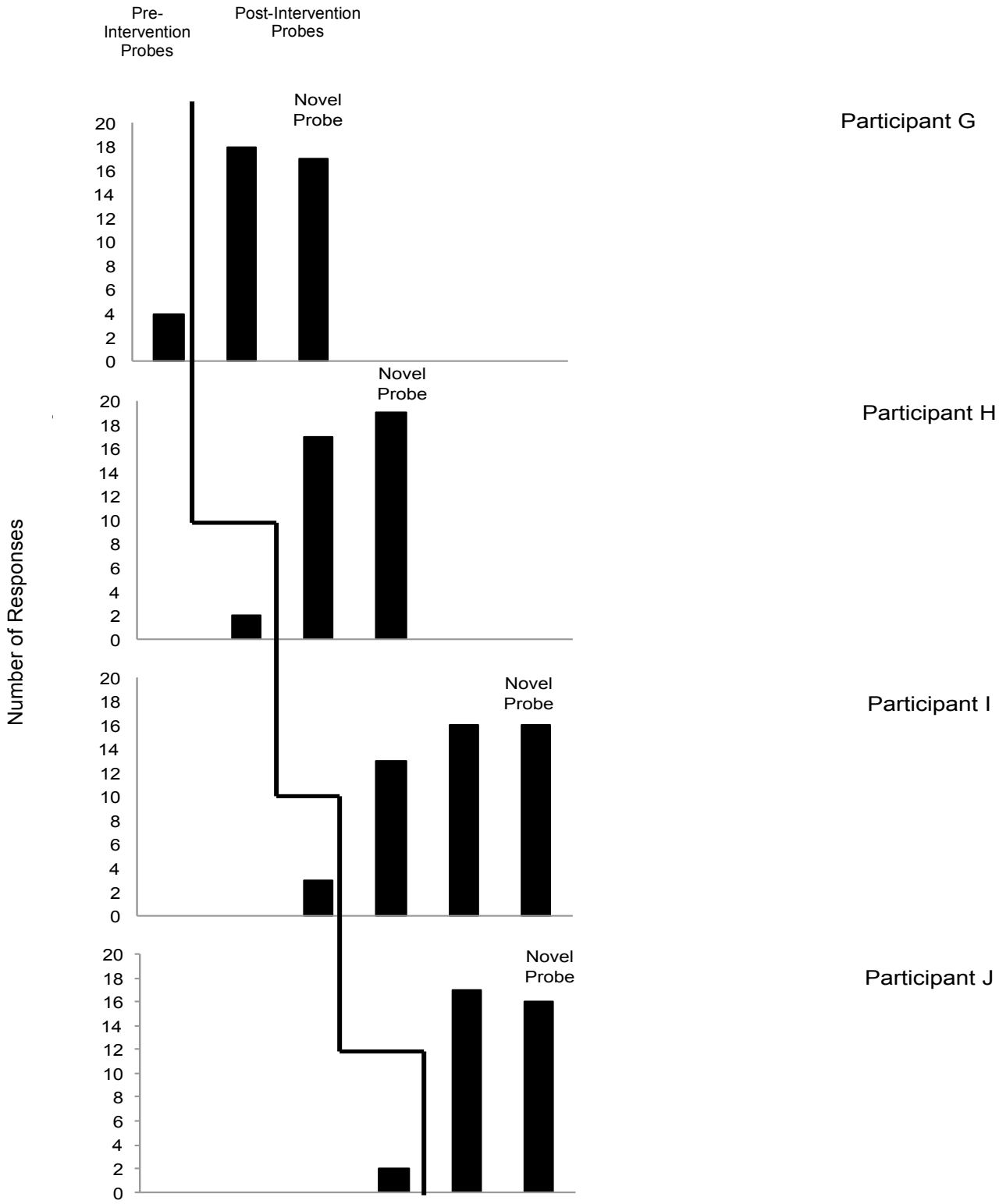


Figure 17: The number of correct acquisition of new operant responses emitted by the participants during pre- and post-intervention probes. The responses are presented out of twenty opportunities. The solid line denotes the observational conditioning-by- denial intervention.

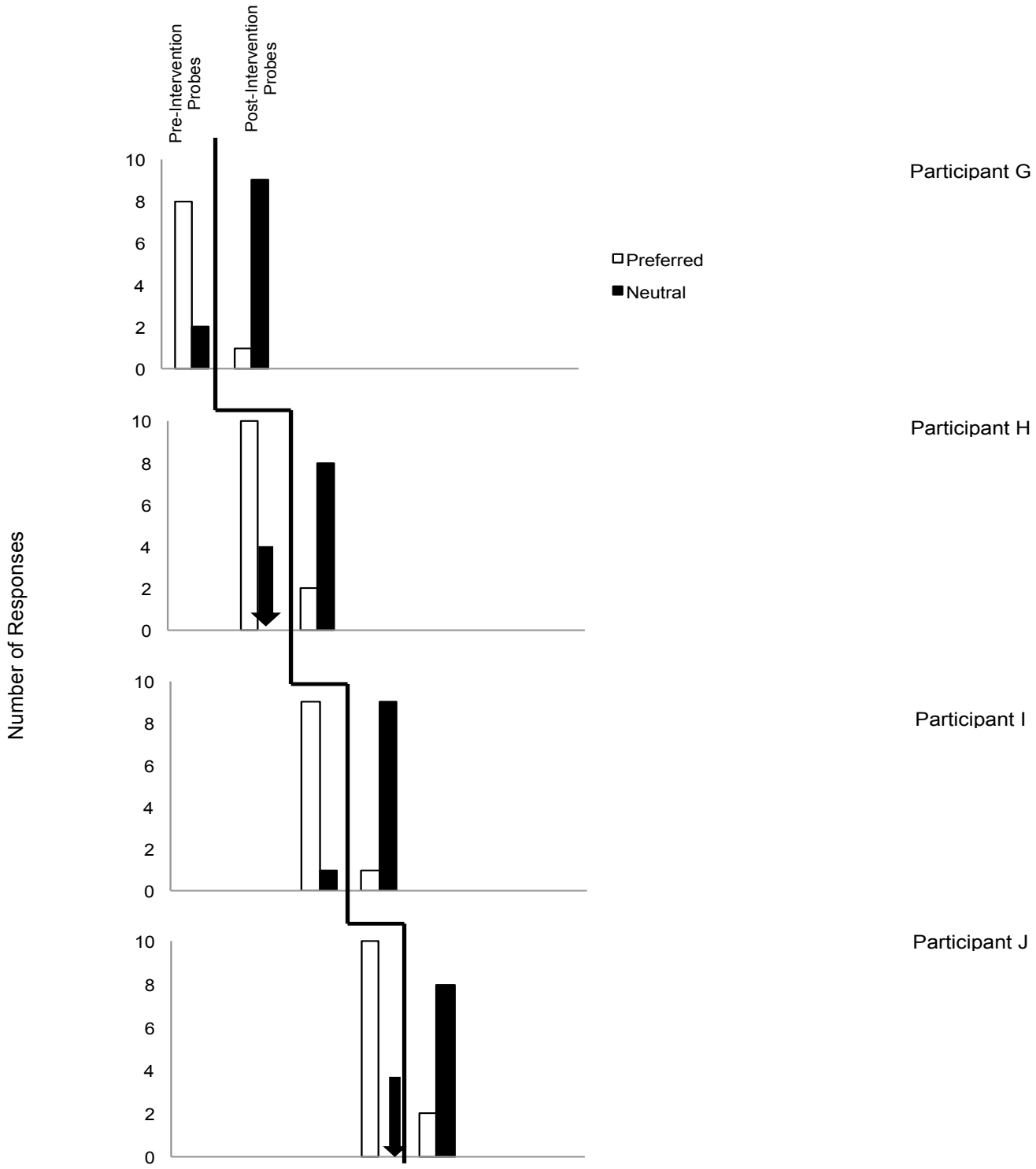
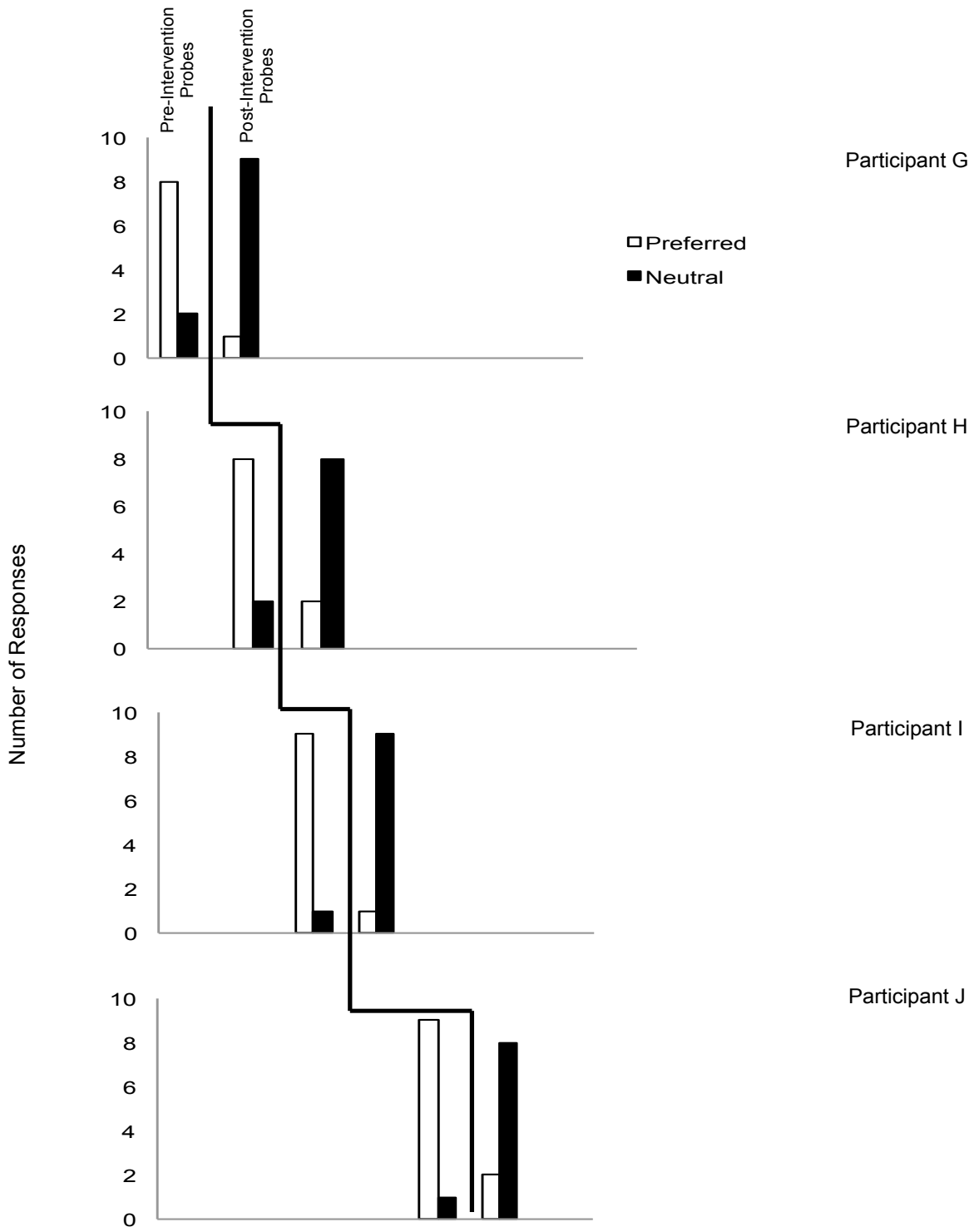
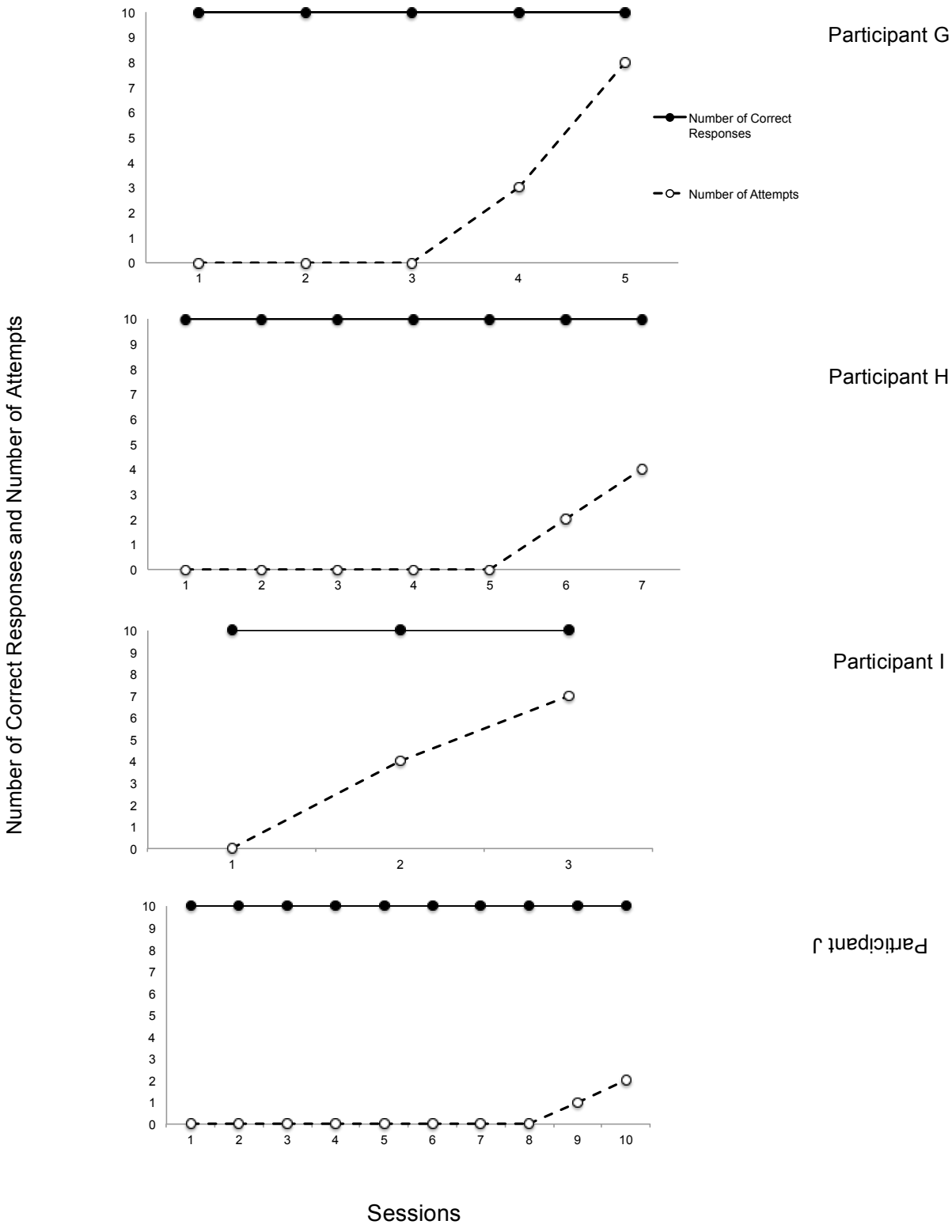


Figure 18: Individual Reinforcer Assessment graphs. The number of times each participant picked a preferred reinforcer or neutral stimulus pre-and post-intervention across individual settings. The solid line denotes the observational conditioning-by-denial intervention.



F*igure 19:* Peer Reinforcer Assessment graphs. The number of times each participant picked a preferred reinforcer or neutral stimulus pre-and post-intervention across peer settings. The solid line denotes the observational conditioning-by-denial intervention



F*igure 20:* The number of correct responses and number of attempts during the observational conditioning-by-denial intervention.

Discussion

The results of the observational conditioning-by-denial intervention showed that all three types of OL were established concluding the intervention. The results of Experiment 2 were similar to those from Experiment 1, suggesting that an observational conditioning- by-denial intervention is an effective intervention to establish all three types of OL. These findings extend Singer-Dudek's et al. (2013) study.

The purpose of Experiment 2 was to test if conditioned reinforcement by observation is a verbal behavior developmental cusp. The findings of Experiment 2 suggest that conditioned reinforcement by observation is a verbal behavior developmental cusp. Following the intervention participants chose previously neutral stimuli (S-hooks, metal washers, or spoon-shelf supports) over known reinforcers in both individual and peer reinforcer assessments.

The results of the individual and peer reinforcer assessments confirm that conditioned reinforcement by observation is a verbal behavior developmental cusp because all participants chose to trade in their tokens for the S-hooks, metal washers, or spoon-shelf supports following the intervention. By definition a verbal behavior developmental cusp is established when an individual can a) acquire new reinforcers without being directly taught and/or b) learn new material at an accelerated rate. Thus, we can confirm that conditioned reinforcement by observation is a verbal behavior developmental cusp because all four participants in Experiment 2 chose to play with the previously neutral stimuli (s-hooks, spoon shelf supports, and metal washers) in the post-intervention probes. As a function of the intervention it appears that the neutral stimuli used in the reinforcer assessments became conditioned reinforcers across all participants. Since all participants selected the initially neutral stimuli without those stimuli being directly conditioned we can confirm that conditioned reinforcement by observation is a verbal behavior developmental cusp.

Limitations

Experiment 2 is not without limitations. Due to the verbal behavior development of the current population in my current classroom, four participants were selected to participate due to the necessary prerequisites (peer-attention). Two or more participants are needed to determine a functional relationship between the intervention and the establishment of establishment of conditioned reinforcement by observation as a verbal behavior developmental cusp.

CHAPTER IV

GENERAL DISCUSSION

Experiment 1 was an extension of Singer-Dudek's et al. (2013) study where I sought to establish conditioned reinforcement by observation, OP, and OL via an observational conditioning-by-denial intervention. Experiment 2 was an extension of Experiment 1 where I sought to determine if conditioned reinforcement by observation is a verbal behavior developmental cusp.

Experiment 1 showed that an observational conditioning-by-denial intervention was an effective intervention to establish all three types of observational learning (conditioned reinforcement by observation, OP, and OL) in four out of six participants. Prior studies used an observational conditioning-by-denial intervention to establish one or two types of observational learning (Baowaidan, 2016; Byers, 2016; Eby & Greer, 2017; Gold, 2013; Greer & Dudek, 2008; Greer et al., 2008; Katz, 2017; Oblak et al., 2015; Sales, 1998; Singer-Dudek et al., 2011; Singer-Dudek, et al., 2013; Singer-Dudek & Oblak, 2013; Zrino & Greer, 2013), but none had demonstrated the establishment of all three using a single intervention.

Experiment 2 was an extension of Experiment 1. The results of Experiment 1 suggest that an observational conditioning-by-denial intervention established conditioned reinforcement by observation, OP, and OL, however, I realized that I did not test if conditioned reinforcement by observation is a verbal behavior developmental cusp. By replacing the pre-reinforcer assessments used in Experiment 1 (for a mastered and three learning tasks) with individual and peer reinforcer assessments in Experiment 2 I was able to measure if conditioned reinforcement by observation is a verbal behavior developmental cusp. The results of Experiment 2 demonstrated similar findings to Experiment 1; an observational conditioning-by-denial intervention established conditioned reinforcement by observation, OP, and OL across all four participants. In

addition, the results of Experiment 2 also demonstrated that conditioned reinforcement by observation is a verbal behavior developmental cusp.

Major Findings and Implications

Experiments 1 and 2 were the first studies that used a single intervention to establish all three types of observational learning. This suggests that children who have the necessary prerequisites can demonstrate conditioned reinforcement by observation, OP, and OL following an observational conditioning-by-denial intervention. In addition, the results of Experiment 1 are consistent with Byers' (2016) and Baowaidan's (2016) studies, suggesting that peer attention is a necessary prerequisite in order to enter an intervention (e.g., observational conditioning-by-denial, repeated probes, peer-yoked contingency) to establish one or more types of observational learning.

Experiment 1 Question: Can an observational conditioning-by-denial intervention establish all three types of OL? The findings of Experiment 1 suggest that peer attention is a necessary prerequisite to establish one or more types of OL. If peers are not conditioned as reinforcers (e.g., a child does not greet other peers, and does not seek to play with them throughout the day) any exposure to an intervention involving peers will not result in the establishment of any type of observational learning because that child will not learn indirectly from observing his or her peer receiving reinforcement or a correction (Greer et al., 2006; Greer & Ross, 2008; Greer & Speckman, 2008; Neu, 2013).

In Experiment 1, two participants did not demonstrate all three types of OL following the intervention. Participants C and E did not have peer attention established prior to the onset of this study. Participant E demonstrated OL because he had BiN (bidirectional Naming) in his repertoire. He was able to learn through incidental exposure to the names of the stimuli, whereas, Participants A, B, D and F only had unidirectional Naming (listener half of Naming) and were

not able to learn the names of the stimuli simply by hearing them. Following the intervention Participants A, B, D and F demonstrated OL because they were able to learn novel material indirectly by observing their peer receive reinforcement or a correction in the post-intervention probes.

The findings of Experiments 1 and 2 showed that when participants had peer attention in repertoire, they were able to acquire conditioned reinforcement by observation, OP, and OL as a function of the intervention. Alternatively, if participants did not have peer attention in repertoire, they did not acquire one or more types of observational learning as a function of the intervention. Baowaidan (2016) found that as a result of a similar observational conditioning-by-denial intervention eight out of nine participants' observing responses to peers increased. Her findings suggest that the observational intervention conditioned peer attention as a conditioned reinforcer, which increased how aware the participants were of their peers in post-intervention probes. Future research should measure peer attention in pre-and post-intervention probes to see what specific components of peer attention are necessary for participants to have in repertoire before they enter an observational intervention and to measure changes in such responses. Future research is needed to test the effects of peer awareness and the establishment of one or more types of observational learning.

The results of Experiments 1 and 2 indicate that following the intervention all participants who demonstrated all three types of OL can now 1) learn novel material indirectly, 2) acquire material at an accelerated rate and 3) learn in new ways. Following the intervention, participants who demonstrated OP can now observe their peers emit a behavior in repertoire. Based upon observing their peer's consequence (e.g., receiving reinforcement or a correction) the participants will either emit the mastered behavior if the behavior was reinforced or will not emit the mastered behavior if the peer received a correction. Prior to the intervention,

participants only acquired novel material in a one-on-one setting, where material was directly taught. Concluding the intervention, participants who acquired OL and OP are now able to learn novel material in group settings, where instruction is often directed to other students or to the group. They are able to learn novel material indirectly by observing their peers receive reinforcement and/or corrections.

Experiment 2 Question: Is Conditioned Reinforcement by Observation a Verbal Behavior Developmental Cusp? The results of Experiment 2 demonstrated that conditioned reinforcement by observation is a verbal behavior developmental cusp. By definition a verbal behavior developmental cusp is established when an individual can a) learn new things, b) learn novel material at a faster rate and c) acquire new reinforcers without directly being taught (Greer & Du, 2015; Greer & Ross, 2008). The reinforcer assessments (individual and peer) I used to empirically determine if conditioned reinforcement by observation is a verbal behavior developmental cusp confirmed that conditioned reinforcement by observation is, in fact, a cusp. Prior to the intervention all four participants selected known reinforcers (e.g., farm animals, MagnaTiles®) over neutral stimuli (S-hooks, spoon-shelf supports, metal washers) in exchange for tokens in both the individual and peer reinforcer assessments, however, after observing their peer receive neutral stimuli while being denied access to those stimuli (binder clips) during the intervention, all four participants selected to trade in their tokens for initially neutral stimuli (S-hooks, spoon-shelf supports, metal washers) in both the individual and peer reinforcer assessments following the intervention.

In addition, prior to this study, participants were never exposed to the binder clips used in the intervention and the Post-it® notes used during the OLR probes. Following the intervention all participants in Experiment 2 either vocally requested/manded or made physical attempts to gain access to the binder clips in the intervention and to the Post-it® notes in the OLR post-

intervention probes. This indicates that conditioned reinforcement by observation is a verbal behavior developmental cusp because they selected previously neutral stimuli without being directly taught (e.g., conditioned) across different post-intervention probes and assessments.

Participants in Experiment 2 had peer attention in their repertoire prior to the onset of the study. The stimuli used in the reinforcer assessments were different than the stimuli that the participants and other children traded in for in the classroom "token store." During the initial peer reinforcer assessment each participant was able to observe his peer play with one of the neutral stimuli for 20-30 s before they were allowed to gain access to the five boxes of stimuli (2 preferred and 3 neutral stimuli) across ten consecutive opportunities. The post-intervention probes demonstrated that participants selected initially neutral stimuli with no additional peer exposure. The individual reinforcer probes occurred first following the intervention. The only time the participants observed their peers play with the initially neutral stimuli was during the pre-intervention assessments. Even though the participants were not denied access to these stimuli during the pre-intervention peer reinforcer assessment, the neutral stimuli may have become conditioned reinforcers via peer modeling.

Darcy (2017) found that when participants were paired with peers via a yoked contingency or peer tutoring where they had to observe their peer in the intervention either receive reinforcement or a correction, participants' rate of learning increased and the emission of vocal verbal operants increased. It could very well be that the participants' initial ten exposures to observing a peer play with the initial neutral stimuli in the peer reinforcer assessment conditioned neutral stimuli as conditioned reinforcers, not the denial condition.

Conditioned Reinforcement by Observation is a Social Developmental Cusp.

According to Skinner (1957) verbal behavior is social behavior. From a radical behaviorist perspective, language is selected out by its consequences (Skinner, 1957). In both

studies the participants needed to observe their peer receive a consequence, whether it was in the form of an approval in the OP and OL probes, or being denied access to receiving stimuli in the OLR probes and intervention. Observing another individual in one's environment receive reinforcement and/or a correction constitutes social behavior. Further, in order for one or more types of OL to be established peer attention must already be present.

Limitations

Both experiments had some limitations. Participants were only exposed to one pre-intervention probe across all dependent variables (OLR, OP, and OL in Experiment 1 and OLR, OP, OL, and the individual and peer reinforcer assessments in Experiment 2). I only exposed the participants to one pre-probe prior to the intervention because prior studies used this design (Baowaidan, 2016; Byers, 2016; Eby & Greer, 2017; Gold, 2013; Greer & Dudek, 2008; Greer et al., 2008; Katz, 2017; Oblak et al., 2015; Sales, 1998; Singer-Dudek et al., 2011; Singer-Dudek, et al., 2013; Singer-Dudek & Oblak, 2013; Zrino & Greer, 2013). However, Byers (2016) found that all three types of OL were established as a result of repeated probes. In Byers' (2016) second experiment she graphed the sequence relation via a pie chart depicting when each participant demonstrated each type of OL. According to Byers (2016) conditioned reinforcement by observation and OP emerged before OL emerged across participants. All three types of OL may have been established as a result of the denial component in the OLR probes. In the OLR probes the participant observed a peer receive neutral stimuli while being denied access to the neutral stimuli across ten consecutive opportunities. The criterion for OLR probes was met, and thus the probe session was ended, when the participant either vocally manded/requested and/or made a physical attempt to gain access to the stimuli. The exposure to the OLR repeated probes may have had the same effect as the intervention because participants were denied access to receiving neutral stimuli (Post-it® notes) while observing their peer receive them. This could have led to

the establishment of all three types of OL. Future studies should test whether a repeated probe design will establish conditioned reinforcement by observation as a verbal behavior developmental cusp. In addition, future studies should note the sequence of the establishment of all three types of OL to see if there is indeed a trajectory of development or to see the effect the establishment of one type of OL has on the other two types of OL.

Future Research

Follow-up Probes. I did not conduct follow-up probes or other probes in natural settings with the stimuli now conditioned as reinforcers in Experiment 2. Zrino and Greer (2013) conducted follow-up probes and found that previously neutral stimuli were still conditioned as reinforcers six and ten weeks later. From an anecdotal perspective, even though I did not test if conditioned reinforcement by observation is a verbal behavior developmental cusp in Experiment 1, Participants B, D, and F continued to request to work for paper clips (used during the pre-and-post reinforcer assessments for mastered and learning tasks) as well as any novel stimuli that I presented to them in the classroom more than six months later. In addition, Participants I and J vocally requested/manded for previously neutral stimuli now conditioned as reinforcers (metal washers, spoon shelf supports, and S-hooks) used in the individual and peer reinforcer assessments following the intervention four weeks later. Future researchers should conduct follow-up probes to measure how long the previously neutral stimuli now conditioned as reinforcers will function as reinforcers.

Specific to the peer reinforcer assessment, future research should explore if the initial exposure to observing a peer play with neutral stimuli establishes conditioned reinforcement by observation as a cusp or if the denial component of the intervention is necessary to establish conditioned reinforcement by observation as a cusp. Katz (2017) and Lee (2016) found that when two peers were present and one participant was denied access to receiving neutral stimuli,

conditioned reinforcement by observation was demonstrated by observing peers as well as the target participant as a result of the denial component of the intervention. Future research should explore having one or more peers in the intervention.

Gender Differences. Gender differences may have played a vital role in the establishment of all three types of observational learning. Due to the small sample, there were only two females who participated in my study. Both females in Experiment 1 (Participant B and D) met criterion on the intervention in two to three sessions whereas, male participants in both Experiments 1 and 2 needed additional intervention sessions before they met criterion. During the intervention the female participants made more vocal/mand requests and physical attempts to gain access to the neutral stimuli (binder clips) the peer was receiving than the male participants. Similarly, during the OLR post-probes both female participants made more attempts to gain access to the neutral stimuli (Post-it® notes) compared to the male participants. Future research should explore gender differences on the establishment of all three types of observational learning.

Conclusion

Results of the present study showed that an observational conditioning-by-denial intervention was an effective intervention to establish all three types of observational learning (conditioned reinforcement by observation, OP, and OL) as well as determined that conditioned reinforcement by observation is a verbal behavior developmental cusp. Further, following the intervention four out of six participants in Experiment 1 and all four participants in Experiment 2 could now: a) learn new things, b) learn novel material at a faster rate and c) acquire new reinforcers without directly being taught (Greer & Du, 2015; Greer & Ross, 2008) following the intervention. There is still much that is unknown about the effectiveness of the procedure in this study-–how long do the newly acquired reinforcers function as reinforcers, and does the initial

exposure to the peer reinforcement control by observation assessment establish conditioned reinforcement by observation as a verbal behavior developmental cusp? However, the present study offers evidence that an observational conditioning-by-denial intervention established three types of OL across participants who had peer attention in their repertoire, while also confirming that conditioned reinforcement by observation is a verbal behavior developmental cusp.

References

Albers, A., & Greer, R. D. (1991). Is the three term contingency trial a prediction of effective instruction? *Journal of Behavioral Education, 1*, 337-354.

Baker, K. A. (2014). The effects of social listener reinforcement and video modeling on the emergence of social verbal operants in preschoolers diagnosed with autism and language delays. (Doctoral dissertation, Columbia University).

Baowaidan, L. (2016). The effects of an observational intervention on audience control by peers in preschool children with developmental and language delays. (Doctoral dissertation, Columbia University).

Bandura, A. (1977). Social learning theory.

Barnes-Holmes, D., Barnes-Holmes, Y., & Cullinan, V. (2000). Relational frame theory and Skinner's Verbal Behavior: A possible synthesis. *The Behavior Analyst*, *23*(1), 69.

Byers, E. M. (2016). An analysis of the relation between preschool children's attention to peers and the presence of the behavioral developmental cusp for learning by observation. (Doctoral Dissertation, 2016, Columbia University).

Catania, A. C. (1998). *Learning* (4th ed). Upper Saddle River, NJ: Prentice Hall.

Cartensen, J. (2013, April). Dress for evolutionary success. *Nautilus.* Retrieved from http://nautil.us/issue/1/what-makes-you-so-special/dress-for-evolutionary-success

Cook, M., Mineka, S., Wolkstein, B., & Laitsch, K. (1998). Conditioning of snake fear in unrelated rhesus monkeys. *Journal of Abnormal Psychology, 94,* 591–610.

Cotter, V. W., & Spradlin, J. E. (1971). A nonverbal technique for studying music preference. *Journal of Experimental Child Psychology*, *11*(3), 357-365.

Curio, E., Ernest, U., & Vieth, W. (1978). Cultural transmission of enemy recognition: One function of mobbing. *Science*, *202*, 899–901.

Darcy, L. (2017). The identification and establishment of reinforcement for collaboration in elementary students. (Doctoral Dissertation, 2017, Columbia University).

Davies-Lackey, A. (2005). Yoked peer contingencies and the acquisition of observational learning repertoires. (Doctoral Dissertation, 2005, Columbia University).

Deguchi, H. (1984). Observational learning from a radical-behavioristic viewpoint. *The Behavior Analyst*, *7*(2), 83.

Delgado, J. A. P., Greer, R. D., Speckman, J. M., & Goswami, A. (2009). Effects of conditioning reinforcement for print stimuli on match-to-sample responding in preschoolers. *The Journal of Speech and Language Pathology–Applied Behavior Analysis*, *3*(2-3), 198-216.

Dinsmoor, J. A. (1950). A qualitative comparison of the discriminative and reinforcing functions of a stimulus. *Journal of Experimental Psychology, 40,* 458-472.

Donahoe, J. W., & Palmer, D. C. (2004). *Learning and Complex Behavior.* Richmond: Ledgetop Publishing.

Du, L., Broto, J. & Greer, R. D. (2015). The effects of the establishment of conditioned reinforcement for observing responses for 3D stimuli on generalized match-to-sample in children with autism spectrum disorders. *European Journal of Behavior Analysis, 16*(1), 82-98. doi.1080/15021149.2015.1065655

Dugatkin, L. A. (1996a). Copying and mate choice. In: *Social Learning in Animals. The Roots of Culture* (Ed. by C. M. Heyes & B. G. Galef, Jr), pp. 85–105. New York: Academic Press.

Dugatkin, L.A. (1996). The interface between culturally-based preference and genetic preference: Female mate choices in *Poecilia reticulata*. *Proceedings of the National Academy of Science, USA, 93*, 2770–2773.

Dugatkin, L.A. & Godin, J.G. (1992). Reversal of female mate choice by copying in the guppy (*Poecilia reticulata*). *Proceedings of the Royal Society of London, 249,* 179–184.

Dugatkin, L. A. & Godin, J.G. (1993). Female mate copying in the guppy *Poecilia reticulata:* age-dependent effects. *Behavioral Ecology, 4,* 289–292.

Dugatkin, L. A. & Godin, J.G. (1998). Effects of hunger on matechoice copying in theguppy. *Ethology, 104,* 194–202.

Dugatkin, L. A., Lucas, J. S. & Godin, J.G. (2002). Serial effects of mate-choice copying in the guppy (Poecilia reticulata). *Ethology, Ecology and Evolution, 14,* 45–52.

Dugatkin, L. A., Druen, M. W. & Godin, J.G. (2003). The disruption hypothesis does not explain mate-choice copying in the guppy (Poecilia reticulata). *Ethology, 109,* 67–76.

Eby, C. M., & Greer, R. D. (2017). Preschoolers' initiation of "spontaneous" verbal interactions: Social reinforcement versus non-social generalized reinforcers. *Behavioral Development Bulletin*.

Epstein R. (1984). Spontaneous and deferred imitation in the pigeon. *Behavioural Processes, 9,* 347–354.

Eva, K., & Wood, T. (2006). Are all the taken men good? An indirect examination of mate-choice copying in humans. *Canadian Medical Association Journal, 175,* 1573–1574.

Fantino, E. (2008). Choice, conditioned reinforcement and the Prius effect. *Behavior Analyst, 31*(2), 95-111.

Fiorile, C. A. & Greer, R. D. (2007). The induction of Naming in children with no prior tact responses as a function of multiple exemplar histories of instruction. *The Analysis of Verbal Behavior, 23,* 71-88.

Galef, B. G., Jr. & White, D. J. 2000. Evidence of social effects on mate choice in vertebrates. *Behavioural Processes, 51,* 167–175.

Gautreaux, G. (2005). The effects of monitoring training on the acquisition of an observational learning repertoire under peer tutoring conditions, generalization and collateral effects (Doctoral dissertation, [Sl: sn]).

Godin, J.J., Herdman, E.J.E., & Dugatkin, L.A. (2005). Social influences on female mate choice in the guppy, *Poecilia reticulata*: generalized and repeatable trait-copying behavior. *Animal Behavior, 69*, 999-1005.

Gold, L. D. A functional analysis on the effects of an observational intervention using a peer-yoked contingency game board on the induction of observational performance, observational acquisition and naming. (Doctoral Dissertation, 2013, Columbia University).

Gollub, L. R. (1970). Information on conditioned reinforcement: A review of Conditioned Reinforcement, edited by D. Hendry. *Journal of the Experimental Analysis of Behavior, 14*, 361-372.

Graziano, W., Jensen-Campbell, L., Shebilske, L., & Lundgren, S. (1993). Social influence, sex differences, and judgments of beauty: Putting the Interpersonal back in interpersonal attraction. *Journal of Personality and Social Psychology, 65,* 522–531.

Greer, R. D. (1980). *Design for music learning*. Teachers College Press.

Greer, R. D. (2002). *Designing teaching strategies: An applied behavior analysis system approach*. San Diego, CAL Academic Press.

Greer, R. D., Becker, B. J., Saxe, C. D., & Mirabella, R. F. (1985). Conditioning histories and setting stimuli controlling engagement in stereotypy or toy play. *Analysis and Intervention in Developmental Disabilities, 5,* 269-284.doi: 10.1016/0270-4684(85)90015-1

Greer, R. D., Dorow, L., Williams, G., McCorkle, N., & Asnes, R. (1991). Peer-mediated procedures to induce swallowing and food acceptance in young children. Journal of Applied Behavior Analysis, 24, 783–790.

Greer, R. D., & Du, L. (2015). Experience and the onset of the capability to learn names incidentally by exclusion. *The Psychological Record*, *65*(2), 355-373.

Greer, R. D., & Keohane, D. D. (2005). The evolutions of verbal behavior in children. *Behavioral Development Bulletin, 1,* 31-47. Reprinted in 2006 in the *Journal of Speech and Language Pathology: Applied Behavior Analysis, 1*, 111-140.

Greer, R. D., & Longano, J. (2010). A rose by naming: How we may learn how to do it. *The Analysis of Verbal Behavior*, *26*(1), 73-106.

Greer, R. D., Pistoljevic, N., Cahill, C., & Du, L. (2011). Conditioning voices as reinforcers for listening responses in preschoolers with autism. *The Analysis of Verbal Behavior, 27*, 103–124.

Greer, R. D. & Ross, D. E. (2008). *Verbal Behavior Analysis: Inducing and Expanding New Verbal Capabilities in Children with Language Delays*. New York, NY: Allyn and Bacon.

Greer, R. D., & Singer-Dudek, J. (2008). The emergence of conditioned reinforcement from observation. *Journal of Experimental Analysis of Behavior, 89*(1), 15-29. doi: 10/1901/jeab.2008.89-15.

Greer, R. D., Singer-Dudek, J., & Gautreaux, G. (2006). Observational Learning, *International Journal of Psychology.*

Greer, R. D., Singer-Dudek, J., Longano, J., & Zrinzo, M. (2008). The emergence of praise as conditioned reinforcement as a function of observation in preschool and school age children. *Revista Mexicana de Psicologia*, *25*(1), 5-26.

Greer, R. D., & Speckman, J. (2009). The integration of speaker and listener responses: A theory of verbal development. *The Psychological Record*, *59*(3), 449.

Greer, R. D., Stolfi, L., Chavez-Brown, M., & Rivera-Valdez, C. (2005). The emergence of the listener to speaker component of naming in children as a function of multiple exemplar instruction. *The Analysis of Verbal Behavior, 21,* 123-134.

Horne, P. J., & Lowe, C. F. (1996). On the origins of naming and other symbolic behavior. *Journal of the Experimental Analysis of Behavior, 65*(1), 185–241 http://doi.org/10.1901/jeab.1996.65-185

Horner, R. D., & Baer, D. M. (1978). Multiple probe technique: A variation of the multiple baseline. *Journal of Applied Behavior Analysis*, *11*(1), 189-196.

Hull, C. (1943). Principles of behavior.

Johnston, J. M., & Pennypacker, H. S. (1993). Strategies and tactics of behavioral research (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Katz, E. R. (2017). The effects of social conditions on learning new reinforcers. (Doctoral dissertation, Columbia University).

Kelleher, R.T. & Gollub, L.R. (1962). A review of positive conditioned reinforcement. *Journal of the Experimental Analysis of Behavior, 5*(4), 543-597.

Keller, F. S., & Schoenfeld, W. N. (1950). *Principles of psychology: A systematic text in the science of behavior.* New York: Appleton-Century Crofts.

Keohane, D. D., Luke, N. & Greer, R. D. (2008). The things we care to see: The effects of rotated protocol immersion on the emergence of early observing responses. *Journal of Early Intensive Behavior Intervention, 5*(1), 23-39. Retrieved from: http://www.baojournal.com/JEIBI/JEIBI-VOL-5/JEIBI-5-1.pdf

Keohane, D. D., Pereira Delgado, J. A., & Greer, R. D. (2009). Observing responses: Foundations of higher order verbal operants. In R. A. Rehfeldt, & Barnes-Holmes, (Eds.), *Derived relational responding: Applications for learners with autism and other developmental disabilities* (pp. 41-62). Oakland, CA: New Harbinger Publications.

Lee, J. (2016). The effects a of social condition on the establishment of direct and indirect conditioned reinforcement for writing by second graders (Order No. 10107565). Available from ProQuest Dissertations & Theses Global. (1791450759).

Longano, J., & Greer, R. D. (2006). The effects of a stimulus-stimulus pairing procedure on the acquisition of conditioned reinforcement for observing and manipulating stimuli by young children with autism. *Journal of Early and Intensive Behavior Interventions, 3,* 135-150.

Maffei, J., Singer-Dudek, J., & Dolleen-Day, K. (2014). The effects of the establishment of adult faces and/or voices as conditioned reinforcers for children with asd and related disorders. *Acta De Investigación Psicológica*, *4*(3), 1621-1641.

Miguel, C. F., Carr, J. E., & Michael, J. (2002). The effects of a stimulus-stimulus pairing procedure on the vocal behavior of children diagnosed with autism. *The Analysis of Verbal Behavior*, *18*, 3-13.

Mineka, S. & Cook, M. (1988). Social learning and the acquisition of snake fear in monkeys. In: Zentall, T.R, Galef, B.F, editors. *Social learning: Psychological and biological perspectives.* Hillsdale, NJ: Lawrence Erlbaum Associates, p. 51–75.

Nuzzolo-Gomez, R., Leonard, M. A., Ortiz, E., Rivera, C. M., & Greer, R. D. (2002). Teaching children with autism to prefer books or toys over stereotypy or passivity. *Journal of Positive Behavior Interventions, 4,* 80-87. doi: 10.1177/109830070200400203

Oblak, M., Greer, R. D., & Singer-Dudek, J. (2015). Valuation alteration: stimuli increase in value when preschoolers deliver them to peers. *The Psychological Record*, *65*(4), 705-716.

Parker, J. & Burkley, M. (2009). Who's chasing whom? The impact of gender and relationship status on mate poaching. *Journal of Experimental Social Psychology, 45,* 1016-1019.

Pavlov, I. P. (1906). The scientific investigation of the psychical faculties or processes in the higher animals. *Science, 24,* 613-619.

Pavlov, I. P. (1927). Conditioned reflexes. *An Investigation of the physiological activity of the cerebral cortex*.

Pereira-Delgado, J., Greer, R. D., Speckman, J., & Goswami, A. (2009). Effects of conditioning reinforcement for print stimuli on match-to-sample responding in preschoolers. *Journal of Speech Language Pathology and Applied Behavior Analysis, 3.2-3.3,* 60-77. Retrieved from http://www.baojournal.com/SLP-q

Pistoljevic, N. (2008). The effects of multiple exemplar and intensive tact instruction on the acquisition of naming in preschoolers diagnosed with autism and other language delays (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3317598)

Pistoljevic, N., & Greer, R. D. (2006). The effects of daily intensive tact instruction on preschool students' emission of pure tacts and mands in non- instructional setting. *Journal of Early and Intensive Behavior Intervention, 3,* 103–120. http://dx .doi.org/10.1037/h0100325

Reilly-Lawson, T., & Walsh, D. (2007). The effects of observational training on the acquisition of reinforcement for listening. *Journal of Intensive and Early Behavior, 4*(2), 430-452.

Rosales-Ruiz, J., & Baer, D. M. (1996). A behavior-analytic view of development. *New Directions in Behavior Development*, 155-180.

Rothstein, M.B., Gautreaux, G.G. (2007). The effects of peer-yoked contingency on observational learning and the collateral emergence of naming. *Journal of Intensive and Early Behavior, 4*(2), 453-470.

Sales, C.D. (1998). Peer effects on the conditioning of a generalized reinforcer on preschool aged children. (Doctoral dissertation, Columbia University, 1998). Abstract from UMI Proquest Digital Dissertations [on-line]. Dissertations Abstracts Item: AAT 9909429.

Schmelzkopf, J., Greer, R. D., Singer-Dudek, J., & Du, L. (2017). Experiences that establish preschoolers' interest in speaking and listening to others. *Behavioral Development Bulletin, 22*(1), 44-66. http://dx.doi.org/10.1037/bdb0000026

Schmitt, D. P. (2004). Patterns of universals of mate poaching across 53 nations: The effects of sex, culture, and personality on romantically attracting another person's partner. *Journal of Personality and Social Psychology, 86,* 560–584.

Schmitt, D. P., & Buss, D. M. (2001). Human mate poaching: Tactics and temptations for infiltrating existing mateships. *Journal of Personality and Social Psychology, 80,* 894–917.

Schoenfeld, W. N., Antonitis, J. J., & Bersh, P. J. (1950). A preliminary study of training conditions necessary for secondary reinforcement *Journal of Experimental Psychology, 40*, 40-45.

Singer-Dudek, J., Choi, J., & Lyons, L. (2013). Effects of an observational intervention on the emergence of two types of observational learning. *European Journal of Applied Behavior Analysis, 14*(2), 1-20.

Singer-Dudek, J., & Oblak, M. (2013). Peer presence and the emergence of conditioned reinforcement from observation. Journal of Applied Behavior Analysis, 46(3), 592-602.

Singer-Dudek, J., Oblak, M., & Greer. R.D. (2011). Establishing books as conditioned reinforcers for preschool children as a function of an observational intervention. *Journal of Applied Behavior Analysis, 44*(3), 421-433.

Skinner, B. F. (1938). *The behaviour of organisms: An experimental analysis*. D. Appleton-Century Company Incorporated.

Skinner, B. F. (1957). *Verbal Behavior,* Acton, MA; Copley Publishing Group.

Skinner, B. F., & Rogers, C. R. (1968). Some issues concerning the control of human behavior.

Sterkin, V. L. (2012). The effects of the social listener reinforcement protocol on the audience control of stereotypy and social operants for students with developmental delays (Doctoral dissertation, Columbia University).

Stolfi, L. (2005). The effects of yoked contingencies on the acquisition of observed learning by preschoolers. (Doctoral Dissertation, Columbia University).

Sundberg, M. L., Michael, J., Partington, J. W., & Sundberg, C. A. (1996). The role of automatic reinforcement in early language acquisition. *The Analysis of Verbal Behavior*, *13*, 21-27.

Thorndike, E. L. (1911). *Animal Intelligence*. New York: Macmillan.

Tomasello, M. (2008). Origins of human communication. MIT press.

Tsai, H., & Greer, R. D. (2006). Conditioned preference for books and faster acquisition of textual responses by preschool children. *Journal of Early and Intensive Behavioral Interventions 3,* 35-60.Retrieved from http://www.baojournal.com/JEIBI/JEIBI-VOL-3/JEIBI-3-1.pdf

Vassare, B. M. (2017). The effects of peer monitoring on observational stimulus control in preschoolers with and without social delays; in-vivo versus video learning versus performance. (Doctoral dissertation, Columbia University).

Williams, B.A. (1994). Conditioned reinforcement: Experimental and theoretical issues. *Behavior Analyst, 17*(2), 261-285.

Wyckoff, L.B. (1952). The role of observing responses in discrimination learning: Part *Psychological Review, 59,* 431–442.

Wyckoff L.B. (1969). The role of observing responses in discrimination learning. In: Hendry D.P, editor. *Conditioned reinforcement.* Homewood, IL: Dorsey Press, p. 237–260.

Yoon. S. Y., & Bennett, G. (2000). Effects of a stimulus-stimulus pairing procedure on conditioning vocal sounds as reinforces. *Analysis of Verbal Behavior, 17,* 75- 88.

Zimmerman, J., Hanford, P. V., & Brown, W. (1967). Effects of conditioned reinforcement frequency in an intermittent free-feeding situation. *Journal of the Experimental Analysis of Behavior, 10*, 331-340.

Zrinzo, M. & Greer, R. D. (2013). Establishment and maintenance of socially learned conditioned reinforcement in young children: Elimination of the role of the adult. *The Psychological Record, 63*, 43-62.